Electrical Manufacturing

ANNOTATED EDITORIAL INDEX

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Contents

Subject Index 2
Association and Professional Activities 2
Basic Science and Engineering 2
Components, Electrical/Electronic 3
Components, Mechanical/Structural 5
Computers 6
Control 6
Design Considerations 8
Drives 10
Generators 11
Instruments and Test Equipment 11
Materials, Electrical/Electronic 11
Materials, Mechanical/Structural 13
Motors 14
Production and Assembly Techniques 14
Testing 14
Research Notes 15
Editorials 16
Design Trends 16
Author Index 17
Alphabetical Subject Cross Index 20
Editorial Subject Classification 22

Subject Index

Subject Classification | Month | Page

ASSOCIATION AND PROFESSIONAL ACTIVITIES

The Engineering Profession

1959 Design Engineering Conference, Staff Report — May — 170
Synopsis of papers to be presented at the 1959 Design Engineering Conference, sponsored by the ASME Machine Design Division. Conference and concurrent show scheduled for May 25-28 at Convention Hall, Philadelphia.

BASIC SCIENCE AND ENGINEERING

Digital Methods in Measurement and Control, M. H. Nothman — Sep — 125
A review of digital techniques directly applicable to problems of instrumentation and control of physical processes. Covers: basic principles of coding, sampling, and quantizing in an easy-to-read non-rigorous manner; digital components and techniques; digital measurement devices; digital control actuators.

The Fundamental Properties of Plastics, T. D. Callinan and A. E. Javitz — Aug — 105
The fundamental science of polymers is discussed and related to the engineering properties of plastics materials. The article explains the basic molecular structures, the chemistry of polymerization, and the effect of electron forces. The theoretical basis for mechanical, electrical and chemical properties is developed with pertinent examples.

Mathematics

Determinants and Matrices, Allan D. Kraus and Gerald F Ross — Dec — 133
The methods of determinants and of matrix algebra are used to minimize the possibilities of error and for time saving in engineering problems involving systems of simultaneous equations or other arrays of mathematical statements. The techniques of using determinants and of thinking in matrix terms are outlined, with examples based on the electrical circuit.

Sampled-Data Systems, Carl O. Carlson — Nov — 137
An introduction to analysis of closed-loop control systems where input or error signal is periodically sampled by a sampling switch, analog-digital converter, digital computer, etc. Covers: impulse response; frequency response; p-transform and z-transform methods; Nyquist, Bode and root-locus diagrams with z transforms. Introduces normalized sT plane, pseudo-sampling and z transforms for table generating functions.

Construction and Use of Alignment Nomograms, D. B. Kececioglu and R. W. Opperthauser — Jun — 112
The advantages, for many forms of engineering data, of alignment nomograms over Cartesian curve displays are described. Methods are outlined for converting curves to alignment nomograms.

Automatic Control System Design—2, Mathematical Techniques — Laplace Transformations, Ira Ritow — May — 150
The second of a five-part series on servomechanism design. The solving of a differential equation through the use of the Laplace transform is described with examples, and the various special properties of the transform are discussed. Impulse functions and the Z transform are also presented.

Automatic Control System Design—1, Mathematical Techniques — Complex Variables, Ira Ritow — Apr — 99
Part one of a five-part series on the design of servomechanisms. Complex numbers are defined and their algebraic manipulation is explained. Functions of complex variables, their integration and differentiation, are also included as well as a discussion of the principle of residues in the study of analytic functions.

A Graphical Analog Computer, A. S. Lermer — Feb — 82
A description, with illustrations, of the use of standard, universal nomographs in solving complicated computational problems. The nomograph scales may be prepared in advance on reproducible paper.

Using Fourier Analysis in Designing Whole Systems, Subsystems, Electrical and Mechanical Devices, Ira Ritow — Feb — 87
One of the basic tools in design engineering. Fourier analysis offers aid in many problem areas—often where not expected. This article, in addition to providing a complete theoretical background, points out the many areas where Fourier analysis can be profitably applied in the design of servomechanisms and control systems and in the "black-box" units and individual components for such systems.

Physics

Low-Noise, Solid-State Microwave Amplifiers, R. D. Haun, Jr., and T. A. Osial — Oct — 139
Basic principles of paramagnetic MASER amplifiers (including ammonia gas, two-level solid-state, three-level solid-state, and optically pumped devices) and parametric MAVAR amplifiers (including semiconductor and ferromagnetic types), plus a brief introduction to the tunnel-diode amplifier.

The Electric Field, Paul G. Jacobs — Jul — 107
Basic principles of electrostatics are presented, beginning with the concept of a field surrounding a charge and a mathematical description

Subject Classification	Month	Page
of the field in terms of intensity vectors. Discussion covers electric induction, capacitance, effects of dielectric, mechanical considerations and field effects in practical devices.		
The Fundamental Nature of Shock and Vibration: Theory, Character and Mechanism of Damage, Principles of Testing, I. Vigness ..... Fundamentals of shock and vibration are discussed and analyzed. The basic information is applied to functional engineering problems: design of equipment to withstand these environments, evaluation of specifications, selection of test methods.	Jun	89
Heat Flow Theory, A. D. Kraus ..... Derivations of the basic equations for conduction, convection and radiation; combined effects. Use of dimensional analysis to establish the parameters and the various "numbers" involved in convection expressions. Solutions of empirical equations using simulated experimental data. Transistor heat-transfer case history.	Apr	123
Fundamentals of Ferromagnetism, A. Arrott and J. E. Goldman ..... This new approach to the study of magnetism is derived from modern solid-state physics and uses the interactions of electrons to explain the basic types of magnetic "motion" (uniform rotation of magnetization, curling and domain wall movement) and the properties of soft magnetic alloys, ferrites and permanent magnet materials.	Mar	109
Introduction to Semiconductor Theory, Ruth F. Schwarz ..... A detailed discussion of the physics of conduction processes in semiconductors presented as a basis for understanding the physical principles of semiconductor components. Classes of devices are described in terms of mathematical and graphical representations of parameters.	Jan	107
Metallurgy		
Key to Metals in Design Engineering, S. H. Avner and H. E. Barkan ..... Basic principles of metallurgy are presented. Structural characteristics of metals are explained and related to design concepts. Physical and mechanical properties of metals are defined and illustrated by tables and charts. The nature and specifications of metals are detailed for better understanding of current literature. The effects of environment and mechanisms of damage are shown and illustrated.	May	123
COMPONENTS, ELECTRICAL/ELECTRONIC		
Radiation Effects Data Sheets on Tubes, Resistors, Capacitors, Semiconductors, Staff Report ..... Tabulated results of a U. S. Air Force investigation of the effect of nuclear radiation on electron tubes, resistors, capacitors, germanium and silicon diodes and germanium and silicon transistors.	Feb	112
European Developments in Electronic Components, G. W. A. Dummer ..... Survey of current developments in Europe in electronic components and basic electronic materials covers contributions from Great Britain, France, Holland, Norway, Switzerland and Germany. Details are given on capacitors, resistors, potentiometers, batteries, magnetic and dielectric materials, among other items.	Jan	131
Capacitors		
Taking Advantage of the Voltage Sensitivity of the Silicon Capacitor, J. G. Hammerslag ..... The silicon junction diode exhibits a capacitance effect which can be varied by changing the d-c bias (back) voltage on the device. Circuit uses include remote control of radio receiver, signal-seeking circuits covering a wide band, as well as automatic gain control and automatic frequency control. Factors affecting	Sep	172
Q of the device are discussed; property curves are included.		
Characteristics of Solid Tantalum Capacitors, A. Lunchick ..... An evaluation of solid tantalum capacitors for equipment design engineers. Based upon studies by U. S. Army Signal Research and Development Laboratories. Data include results of environmental and life tests.	Jun	74
Contact Devices		
Contact Research Expanded, Staff Report ..... A report on the recent Engineering Seminar on Electrical Contacts held at Pennsylvania State University, with summaries of some of the technical papers presented. Test methods and circuits and analyses of the mechanics of contact operation are included.	Aug	132
Relay Test Code Advanced, Arnold E. Rudahl ..... Definitions of terminology, discussions of methods, equipment and specifications involved in relay testing have been under intensive study by a committee of the relay industry. A progress report is now ready and available. This report and other relay design and use trends were discussed at the Seventh National Conference on Electromagnetic Relays, summarized here.	Jul	81
The Miniature Relay in Great Britain, J. H. Mitchell and L. S. Distin ..... Design difficulties presented by the multiple requirements for smaller relays to operate reliably in increasingly rigorous environments have been solved by various means in the U. S. and abroad. Outlined here are some of the British solutions and views of the problems.	May	106
Simple Sensing Relay Uses Ferroresonant Circuit, L. L. Weber ..... The ferroresonant relay takes advantage of the non-linearity of an iron-core inductance and of the series-resonant circuit to give a low cost and rugged voltage-sensitive device. Relay application aspects and circuits are presented with a description of the operating principles.	Apr	143
10-Bit Resolution in Shaft-Position to Digital Encoder, W. E. Stupar ..... A newly developed shaft-position to digital encoder is described and application notes are given. The unit achieves efficient, accurate 10-bit resolution without ambiguities and in a small size.	Jan	138
Magnetic Components		
Magnetic Amplifier Computing Control Circuits, Staff Report ..... Building-block approach to analog control circuitry using standardized plug-in precision magnetic amplifiers: amplifier design of one manufacturer (Acromag, Inc.), basic circuits, typical applications, procedures for designing equation-solving circuitry to implement Laplace transforms.	Dec	102
Magnetic-Amplifier Conference Stresses Applications, Staff Report ..... A brief report on the 1959 Special Technical Conference on Non-Linear Magnetics and Magnetic Amplifiers sponsored jointly by the AIEE Committee on Magnetic Amplifiers and the IRE Professional Group on Industrial Electronics, held in Washington, D. C., September 23 to 25.	Dec	149
Static Current and Voltage Control Systems, Baruch Berman ..... Circuits and performance data for a current regulator and a voltage-sensing system are presented as examples of static control technique. The magnetic amplifier, the Zener diode and the magnetic reset reactor are used in circuits that exploit particular properties of these devices.	Nov	157
Low-Noise, Solid-State Microwave Amplifiers, R. D. Haun, Jr., and T. A. Osial ..... Basic principles of paramagnetic MASER amplifiers (including ammonia gas, two-level solid-	Oct	139

Subject Classification	Month	Page
state, three-level solid-state, and optically pumped devices) and parametric MAVAR amplifiers (including semiconductor and ferromagnetic types), plus a brief introduction to the tunnel-diode amplifier.		
Core Factors in Static Magnetic Switch Performance, R. W. Durkee — In magnetic switch circuits, the saturable transformer is the key operating component. The magnetic characteristics of the transformer core have direct and determinative effect on the switch operating limits. Core permeability is the critical factor, and can not be controlled closely. Test and design methods are outlined for measuring and making design allowance for core property variations.	Oct	134
Current-Limiting Power Transformers, H. L. Garbarino and L. J. Stratton — One method of obtaining current-limiting action is by the use of transformers having high leakage reactances, best achieved by providing low-reluctance, leakage-flux paths in the magnetic circuits. Design of magnetic shunts and determination of dependent transformer parameters by the use of equivalent circuits are outlined.	Oct	116
Joint Factors in Stacked Magnetic-Core Design, D. M. Douglas — Magnetic design and material application for stacked cores as used in E-I transformers are greatly facilitated by separating inherent materials properties from the effects of core joints and other mechanical aspects. A method for doing this is outlined, supported by illustrative test data.	Sep	117
High-Gain Magnetic Amplifier in Bridge Circuit, S. D. Warner — Description of a magnetic amplifier consisting of four windings (two each on two coils) connected in a bridge. It has high gain at high temperatures (since only one low-rated rectifier is required). Design parameters and calculations are given.	Sep	114
"Magnistor" Devices for Digital and Logic Circuits, Staff Report — New solid-state component developed by the Potter Instrument Company combines a "soft" magnetic ferrite with a mildly "hard" ferrite in a multiple-flux-path configuration with the properties of a 1-bit comparator or "half adder less carry."	Aug	74
Static Switching Today, J. J. Duffy and S. Spatz — A comprehensive survey of static switching as it is applied today in machine control systems. Includes theory of switching circuits and how the various types of devices (semiconductor, magnetic amplifiers, ferromagnetics) are applied and covers problems encountered in their design and use. Units supplied by various manufacturers are also evaluated.	May	161
Electromagnet Copper-to-Iron Ratio For Optimal Design, T. Lindstrom — The magnetic circuit and winding of an electromagnet are analyzed in detail, with emphasis on the key factors of temperature rise and copper-to-iron ratio. A typical electromagnet design is presented.	Mar	105
New Developments in Magnetic Materials and Applications, William Arrott — The design significance of research progress reported at the 1958 AIEE Conference on Magnetism and Magnetic Materials for: computer elements, microwave components, permanent magnets, soft magnetic alloys, and new magnetic devices.	Feb	56
Designing Optimum Inductors with Ferrite-Biased Gaps, J. T. Ludwig — Barium ferrite gaps permit up to 78 per cent volume reduction over air-gap designs of iron-cored inductors carrying superposed alternating and direct currents. Analysis and synthesis procedures presented for optimum inductors with iron (Audio A) or ceramic (Ferramic H) cores.	Jan	78

Subject Classification	Month	Page
Printed Circuits		
Packaged Electronic Circuits, A. S. Khouri — Miniaturized printed-circuit assemblies utilize printed capacitors and resistors on ceramic plates with supplementary capacitors where needed. Provision for circuit alignment with active components (tubes, transistors) is also possible.	Oct	164
Protective Coating for Missile Printed Circuits, A. E. Hawley and W. E. Weber — This report provides data on the formulation and characteristics of several coatings specially developed for the exacting requirements of printed circuits in missile electronic systems. Test procedures are also detailed.	Jun	58
Protective Devices		
Service Conditions in Motor-Protector Selection, A. P. White — With the increase in automatic control, motors are exposed to more complex service cycles and arduous ambients. This fact, and the present practice of applying thermal protectors up to the maximum allowable limit of temperature rise, makes it necessary that the protectors be selected for particular service. Service conditions and methods of significant testing for protector selection are related.	Dec	164
Inherent Motor Overheat Protection Moves inside the Field Coils, G. P. Gibson, J. J. Courtin and W. H. Elliot — Spurred by protection problems raised in polyphase hermetic motor applications where the ratio of full-load to locked-rotor current is low, two solutions to the problem of putting temperature sensors in the stator windings have been found. Both involve semiconductor thermistors, but in opposite modes of operation — as non-linear positive and as negative-temperature-coefficient resistors. Applications to general-purpose squirrel-cage motors are in the offing.	Nov	125
Circuit Factors in Motor Protection, H. J. Wilt — In selecting and applying protective devices for machine and equipment drive motors, the protected motor or other load is only one factor to be considered. The various possible arrangements of protective devices and the important power-circuit aspects that must be analyzed for adequate and efficient short-circuit and overload protection are discussed.	Jun	66
Overcurrent Protection of Semiconductor Rectifiers, F. W. Gutzwiller — Rectifier overcurrent protection techniques. Examples are given of fault-protection coordination for circuits with and without current-limiting impedances and for circuits providing non-interrupted service upon rectifier cell failure.	Apr	106
New Hotter Motors Demand Thermal Protection, V. G. Vaughan and A. P. White — New, higher temperature limits permitted by revised Underwriters' requirements impose an even greater need for appliance-motor thermal protection. Higher temperature effects on insulation life expectancy also make temperature measurement methods a more critical question. Both aspects of the new regulations are discussed in detail.	Feb	108
Resistors		
Realistic Temperature-Power Derating Requirements for Carbon-Composition Resistors, J. L. Easterday and H. Braner — The results of a Signal Corps-sponsored program to develop more realistic derating curves for carbon-composition resistors. Two methods have been developed for the component application engineer. The first method shows degradation of the resistor at high temperature in terms of the deviation of the resistance from the initial value as a function of load for a life of 2000 hr; the second indicates derating requirements for a maximum of 20 per cent	Mar	141

Subject Classification	Month	Page
resistance deviation from normal during 2000-hr life.		
Metallized Glass-Fiber Resistors — A British Development, G. W. A. Dummer and D. M. Benham Characteristics and fabrication of British-developed metallized glass-fiber resistors are described. Performance is similar to that of wirewound resistors, but the resistance value is approximately 50 times that of the wirewound in the same space. The 2.5-watt resistors are made up to 1.4 megohms in a size only 9/32 in. diam by 7/8 in. long. Slightly smaller 1-watt resistors are made up to 700,000 ohms in a size 7/32 in. diam by 1/2 in. long.	Jan	135
Non-Linear Resistors as Voltage Regulators, J. Zdzieborski and R. E. Post, Jr. Methods are outlined for determining the voltage-current characteristics of non-linear resistors and for expressing these in forms suited to circuit analysis. The methods are illustrated in connection with a common application of non-linear resistors, a bridge form of voltage regulator circuit.	Jan	152
Semiconductor Devices		
Rectifier Voltage Transients — Causes, Detection, Reduction, F. W. Gutzwiller The many advantages of semiconductor rectifiers are well-known. Their extreme sensitivity to voltage transients, however, can be the source of considerable difficulty if proper steps are not taken in the designing of the circuit to reduce the transients. The conditions which generate transients are enumerated, means of detecting them are described, and corrective measures prescribed.	Dec	167
Low-Noise, Solid-State Microwave Amplifiers, R. D. Haun, Jr., and T. A. Osial Basic principles of paramagnetic MASER amplifiers (including ammonia gas, two-level solid-state, three-level solid-state, and optically pumped devices) and parametric MAVAR amplifiers (including semiconductor and ferromagnetic types), plus a brief introduction to the tunnel-diode amplifier.	Oct	139
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Transistors Demonstrate Reliability in Critical Nuclear Instrumentation, R. F. Shea Applications of transistor d-c amplifiers in nuclear reactor instrumentation and control where reliability is paramount from a safety point of view. Included in this discussion are differential amplifiers, chopper-modulated amplifiers, diode-ring modulators, and conventional direct-coupled amplifiers.	May	111
Static Switching Today, J. J. Duffy and S. Spatz A comprehensive survey of static switching as it is applied today in machine control systems. Includes theory of switching circuits and how the various types of devices (semiconductor, magnetic amplifiers, ferromagnetics) are applied and covers problems encountered in their design and use. Units supplied by various manufacturers are also evaluated.	May	161
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Introduction to Semiconductory Theory, Ruth F. Schwarz A detailed discussion of the physics of conduction processes in semiconductors presented as a basis for understanding the physical principles of operation of semiconductor components. Classes of devices are described in terms of mathematical and graphical representations of parameters.	Jan	107
High-Temperature Capabilities of Germanium Transistors, J. O. Dick Test results on sample lots of two types of germanium transistors indicate that reliable short-term operation to 110 C can be obtained with proper stabilization circuitry for small-signal amplifiers.	Jan	149
Switches		
Electrochemical Static Control Switches High-Power A-C, Staff Report A component is described which will switch or modulate a-c currents upon the application of a small d-c current to one of three electrodes immersed in an electrolytic bath. Other two electrodes in encapsulated cell carry load current to be switched or modulated.	Sep	182
Contact Research Expanded, Staff Report A report on the recent Engineering Seminar on Electrical Contacts held at Pennsylvania State University, with summaries of some of the technical papers presented. Test methods and circuits and analyses of the mechanics of contact operation are included.	Aug.	132
The Proximity Limit Switch, C. F. Meyer A description of the design and application of the proximity limit switch, a sensing device which detects the presence of an object without making mechanical contact. This reliable, accurate input component is finding increasing use in new, fast-operating industrial control systems.	Feb	68
Transducers		
Accelerometers and Their Characteristics, E. B. Canfield A survey of the many types of accelerometers that are available today, with particular emphasis on their characteristics when used in servo systems such as those found in missile inertial guidance. Also includes an account of the problem involved in inertial guidance and a list of accelerometer manufacturers.	Nov	117
D-C Torque Motors for Servo Applications, D. G. O'Brien The torque motor, an electromagnetic transducer, has grown rapidly in the last few years in the variety and number of its applications in servo systems. The theory of its operation (including development of its frequency response) and information necessary to its correct application are given.	Jul	76
COMPONENTS, MECHANICAL/STRUCTURAL		
Bearings		
Military Specifications for Ball-Bearing Lubricants, H. Villaume Selected lubricating oils and greases for high- and low-temperature operation of ball bearings in electronic equipment are described from military specifications. Properties, characteristics, operating conditions and sources of supply are listed. Supported by charts and graphs detailing special conditions and materials.	Dec	128
Tests for Smooth-Running Rolling-Contact Bearings, T. W. Morrison and T. Tallian To overcome misleading comparative ear tests for noisy bearings, a method of vibration testing using spectrum analysis is described. Correlation is made with quiet motors. Other objective tests apply to spindle bearings. Tells what the manufacturer can do to measure and control waviness in surfaces of bearing parts, found to be the chief cause of noise and vibration.	Jul	100

Subject Classification	Month	Page
Fasteners		
Standards for Tapping Screws, E. F. Perout A summary of the internal standards developed by Western Electric to insure proper choice and application of tapping screws. Includes tables of strengths of fastenings under torsion, tension, impact, shear and fatigue.	May	147
Gears and Pinions		
Instrument Gearhead Application Factors, F. W. Wood, Jr. A review of the various important elements to be considered in specifying instrument gearheads: dimensional tolerances and their meanings, materials, overall performance, and various forms of accessories such as limit stops and slip clutches.	Feb	122
Housings		
Mechanical Aspects of Control-Center Design, J. L. Defandorf Details of the Unitrol concept of industrial motor control-center design: a modular assembly consisting entirely of standardized components permits almost unlimited original design flexibility and subsequent in-field changeability for a given control-center installation.	Jul	98
COMPUTERS		
Computer Design		
The Four-Bar Linkage as a Function Generator, W. D. Weinstein The accuracy and scope of use of the four-bar linkage can be extended by a more profound grasp of the basic mechanism. The characteristics and design of the elemental "link" and then of its more complex combinations are reviewed and demonstrated.	Oct	155
"Magnistor" Devices for Digital and Logic Circuits, Staff Report New solid-state component developed by the Potter Instrument Company combines a "soft" magnetic ferrite with a mildly "hard" ferrite in a multiple-flux-path configuration with the properties of a 1-bit comparator or "half adder less carry."	Aug	74
Numerical Controller Uses Magnetic Counters, C. Isborn A description, with circuit details, of a new controller developed for use with a coil-winding machine but equally applicable to other similar operations. Simplicity and high reliability are provided by the magnetic counting circuits used.	Jul	96
New Developments in Magnetic Materials and Applications, William Arrott The design significance of research progress reported at the 1958 AIEE Conference on Magnetism and Magnetic Materials for: computer elements, microwave components, permanent magnets, soft magnetic alloys, and new magnetic devices.	Feb	56
10-Bit Resolution in Shaft-Position to Digital Encoder, W. E. Stupar A newly developed shaft-position to digital encoder is described and application notes are given. The unit achieves efficient, accurate 10-bit resolution without ambiguities and in a small size.	Jan	138
CONTROL		
Case Histories		
The Case for Pump Servos In Machine Drive and Control Systems, William Arrott The general applicability of variable-displacement pumps for applications over 10 hp is established by the design considerations that led Minneapolis-Honeywell engineers to select pump servos for the two 2-axis tracer controls (22.5 hp per axis) and 200-hp spindle drive of a large Hufford spin-forge machine.	Dec	158
Automatic Circuit Analyzer Programs Its Own Tests, Kurt Enslein and H. J. Kirschnick Design details of first-of-its-kind analyzer that analyzes terminal-to-terminal continuity of prototype cable harnesses and electrical/electronic equipments and prepares both a printed tape for comparison with design specifications and a punched tape for programming its own leakage and continuity tests on subsequent production models. Identifies kind and location of errors.	Nov	106
Logic-Circuit Modules for Industrial Control Systems, W. Floyd A description of the way in which basic circuit modules and building blocks are combined to make up a control system for a 3-axis machine tool. Basic circuits discussed include flip-flops, AND and OR gates, and delay line storage.	Oct	172
Positioning Accuracy to 0.01 Inch with Simplified Numerical Control, Staff Report Application of Farrand punched-tape control to a multiple-head, inert-atmosphere, arc spot-welding machine built for Linde by Expert Welding Machine Co. Linear positioning accuracy of 0.01 in. obtained by simplified servo system employing coarse and fine resolvers for feedback, tapped transformers for digital/analog signal conversion from the punched tape, electrohydraulic servo valves, hydraulic motors and ball-bearing lead screws.	Aug	98
Numerical Controller Uses Magnetic Counters, C. Isborn A description, with circuit details, of a new controller developed for use with a coil-winding machine but equally applicable to other similar operations. Simplicity and high reliability are provided by the magnetic counting circuits used.	Jul	96
Design Changes Refine Jig Borer Control, Staff Report A report on the changes and improvements that have been made in the design of the numerical control system for the Pratt and Whitney No. 4EA Jig Borer. Changes include a switch to 1-in. punched tape and the addition of a display panel to indicate position and telephone dials for manual control.	Jul	119
Overspeed-Overtorque Detection by Pulse Timing, M. E. Fitch A unique pulse-timing method is used to provide control of speed and torque in a system for testing high-speed (110,000 rpm) components such as bearings and shaft seals.	Jun	84
Simple Sensing Relay Uses Ferroresonant Circuit, L. L. Weber The ferroresonant relay takes advantage of the non-linearity of an iron-core inductance and of the series-resonant circuit to give a low cost and rugged voltage-sensitive device. Relay application aspects and circuits are presented with a description of the operating principles.	Apr	143
Copying Lathe Programmed by Stepping Switches, R. T. Fenn The roughing cuts on a Fischer lathe operation are controlled by information set into an automatic control system on selector switches. A description of the transfer of this numerical information from the selector switches to the control of the machine through stepping switches.	Mar	86
The Team Approach in Applying Numerical Control to a Machine Tool, Staff Report The adaptation of numerical programmed controls to machine tools has created the need for a team approach in integrating packaged electrical "directors" into the conventional magnetic control system normally designed by the machine builder. To pinpoint this trend and delineate the decision areas, a case history is presented involving the adaptation of General Electric Numerical Positioning Controls to a multiple-spindle boring machine designed by Barnes Drill Co.	Feb	76

Subject Classification	Month	Page
Flexible Programming With Optical "Punched" Cards, Arnold E. Rudahl Semi- and fully-automatic pre-set control systems for stage and studio lighting are described. Design details are given for the magnetic amplifiers, miniature slide-wire controls and of a light-beam card programming system.	Jan	100
Systems and Servos		
Magnetic Amplifier Computing Control Circuits, Staff Report Building-block approach to analog control circuitry using standardized plug-in precision magnetic amplifiers: amplifier design of one manufacturer (Acromag, Inc.), basic circuits, typical applications, procedures for designing equation-solving circuitry to implement Laplace transforms.	Dec	102
The Case for Pump Servos in Machine Drive and Control Systems, William Arrott The general applicability of variable-displacement pumps for applications over 10 hp is established by the design considerations that led Minneapolis-Honeywell engineers to select pump servos for the two 2-axis tracer controls (22.5 hp per axis) and 200-hp spindle drive of a large Hufford spin-forge machine.	Dec	158
Accelerometers and their Characteristics, E. B. Canfield A survey of the many types of accelerometers that are available today, with particular emphasis on their characteristics when used in servo systems such as those found in missile inertial guidance. Also includes an account of the problem involved in inertial guidance and a list of accelerometer manufacturers.	Nov	117
Static Current and Voltage Control Systems, Baruch Berman Circuits and performance data for a current regulator and a voltage-sensing system are presented as examples of static control technique. The magnetic amplifier, the Zener diode and the magnetic reset reactor are used in circuits that exploit particular properties of these devices.	Nov	157
A Double-Integration Hydraulic Servo, D. J. Mager and O. A. Walker Description and theory of operation of the electrohydraulic servo system which controls the tail turret on the B-52 intercontinental bomber. Double integration provides for error-less tracking of a target (following a constant-velocity signal) and fast system response insures rapid acquisition of a new target.	Oct	130
Core Factors in Static Magnetic Switch Performance, R. W. Durkee In magnetic switch circuits, the saturable transformer is the key operating component. The magnetic characteristics of the transformer core have direct and determinative effect on the switch operating limits. Core permeability is the critical factor, and can not be controlled closely. Test and design methods are outlined for measuring and making design allowances for core property variations.	Oct	134
Regulation of Airborne Rotating Inverters, W. J. Kreider and N. Jasper Design, development and testing of a voltage- and frequency-regulating system for use on inertially guided ballistic missiles. Technical aspects and performance and measuring techniques are explained. Application to other than airborne systems is also discussed.	Sep	103
"Magnistor" Devices for Digital and Logic Circuits, Staff Report New solid-state component developed by the Potter Instrument Company combines a "soft" magnetic ferrite with a mildly "hard" ferrite in a multiple-flux-path configuration with the properties of a 1-bit comparator or "half adder less carry."	Aug	74
Machine Tool Forum Tackles Design Problems, Staff Report A report of the 23rd Westinghouse Machine Tool Forum. General trends evidenced during the sessions are discussed and selected papers summarized. The latter include those on variable-speed drives, new components, and machine control systems.	Jun	116
Unique Operating Characteristics Offered by Printed-Circuit Motor, J. Henry-Baudot and R. P. Burr Practical development of the principle of printing the windings of d-c motors has led to a new basic motor design that offers many advantages for both control and power uses. Typical motor performance, design details and application factors are outlined.	May	116
Static Switching Today, J. J. Duffy and S. Spatz A comprehensive survey of static switching as it is applied today in machine control systems. Includes theory of switching circuits and how the various types of devices (semiconductor, magnetic amplifiers, ferromagnetics) are applied and covers problems encountered in their design and use. Units supplied by various manufacturers are also evaluated.	May	161
Load Control Systems, F. P. Dunigan A description of devices used to protect machinery and tooling from dangerous overloads by sensing increases in drive-motor current.	Apr	120
Missile Control "Bread Board" Trainers, L. Stolerow A brief description is presented of a magnetic-tape-controlled programming system for use in training missile control technicians and engineers. The flight control computer trainer for the Jupiter missile is illustrated.	Mar	155
The Proximity Limit Switch, C. F. Meyer A description of the design and application of the proximity limit switch, a sensing device which detects the presence of an object without making mechanical contact. This reliable, accurate input component is finding increasing use in new, fast-operating industrial control systems.	Feb	68
Simplifying Servo-System Analysis, G. Gorten and H. A. Irwin The transfer function of a small, closed loop system with rate feedback is reduced to that of a single equivalent motor, thus simplifying the analysis of the larger, multi-loop system of which it is a part. A complete step-by-step description of the procedure and its application is given.	Feb	118
Flexible Programming With Optical "Punched" Cards, Arnold E. Rudahl Semi- and fully-automatic pre-set control systems for stage and studio lighting are described. Design details are given for the magnetic amplifiers, miniature slide-wire controls and of a light-beam card programming system.	Jan	100
10-Bit Resolution in Shaft-Position to Digital Encoder, W. E. Stupar A newly developed shaft-position to digital encoder is described and application notes are given. The unit achieves efficient, accurate 10-bit resolution without ambiguities and in a small size.	Jan	138
Gearless Drive for Power Servo, E. B. Canfield A detailed, technical description of a new approach to the design of power drives for use in high-performance servo applications. Backlash and resonance difficulties are avoided by the elimination of gearing between the drive motor, the load, and the response element: i.e., the motor is actually built in, as part of the load, and rotates at the same speed as the load.	Jan	142
Non-Linear Resistors as Voltage Regulators, J. Zdzieborski and R. E. Post, Jr. Methods are outlined for determining the voltage-current characteristics of non-linear resistors and for expressing these in forms suited to circuit analysis. The methods are illustrated in connection with a common application of non-linear resistors, a bridge form of voltage regulator circuit.	Jan	152

Subject Classification	Month	Page
Dual Power-Source System Speeds Regulator Response, Charles Lane Diodes are used in a new system for voltage regulation of a-c generators that employ rotating exciters. Efficiency and fast response are obtained in a low-cost and compact regulator. Circuits and test data support the detailed description.	Jan	156
Theory		
Control-System Representations, Ira Ritow A 2-page chart presenting quick-reference information useful in servo design. Seven basic control systems are shown in schematic form. Below them are their respective analog equivalent circuits, transfer functions, Bode and Nyquist plots, and frequency responses. A supplement to the recently published series on Automatic Control System Design.	Dec	182
Sampled-Data Systems, Carl O. Carlson An introduction to analysis of closed-loop control systems where input or error signal is periodically sampled by a sampling switch, analog-digital converter, digital computer, etc. Covers: impulse response; frequency response; p-transform and z-transform methods; Nyquist, Bode and root-locus diagrams with z transforms. Introduces normalized sT plane, pseudo-sampling and z transforms for table generating functions.	Nov	137
The Four-Bar Linkage as a Function Generator, W. D. Weinstein The accuracy and scope of use of the four-bar linkage can be extended by a more profound grasp of the basic mechanism. The characteristics and design of the elemental "link" and then of its more complex combinations are reviewed and demonstrated.	Oct	155
Digital Methods in Measurement and Control, M. H. Nothman A review of digital techniques directly applicable to problems of instrumentation and control of physical processes. Covers: basic principles of coding, sampling, and quantizing in an easy-to-read non-rigorous manner; digital components and techniques; digital measurement devices; digital control actuators.	Sep	125
Automatic Control System Design—6, Design by Root-Locus, Ira Ritow The root-locus technique of servo design is developed from the basic characteristic equation. The meaning and significance of the various features of a root-locus plot and how it is used to determine system stability are discussed and illustrated by example.	Sep	153
Automatic Control System Design—5, The System Equation, Ira Ritow Whereas the previous article dealt with the system transfer function, this article shows how to use the system equation (which relates output to input directly) to determine stability and performance. Various means (including Lin's Method) of solving the system equation are given and Routh's criterion for stability is described. Also includes discussion of transient response and error constants.	Aug	136
Automatic Control System Design—4, Design by Transfer Function Methods, Ira Ritow The use of the transfer function of a system in determining system stability and response is covered in this fourth article of the series. System analyses using the Nyquist criterion and the Bode diagram are covered and means of improving performance by design changes are prescribed.	Jul	134
Automatic Control System Design—3, Frequency Response and Transfer Functions, Ira Ritow This, the third article in the series, deals with the frequency response and transfer functions of various devices and components used in servo systems. Transfer functions of a pressure transducer, a tachometer generator and other devices are developed.	Jun	129
Automatic Control System Design—2, Mathematical Techniques — Laplace Transformations, Ira Ritow The second of a five-part series on servomechanism design. The solving of a differential equation through the use of the Laplace transform is described with examples, and the various special properties of the transform are discussed. Impulse functions and the Z transform are also presented.	May	150
Automatic Control System Design—1, Mathematical Techniques — Complex Variables, Ira Ritow Part one of a five-part series on the design of servomechanisms. Complex numbers are defined and their algebraic manipulation is explained. Functions of complex variables, their integration and differentiation, are also included as well as a discussion of the principle of residues in the study of analytic functions.	Apr	99
DESIGN CONSIDERATIONS		
Appearance		
The Model as a Design Aid, D. R. Witt A discussion of the various forms of design models and their selection for the successive phases of presenting design ideas. A guide to materials and fabricating methods used in modelmaking is included, with a list of typical modelmaking specialists.	Jun	109
Components Design Factors		
Value Engineering as a Factor In Product Design, B. W. Eades To enlist the much-needed cooperation of the design engineer, a value engineer explains his work, also the techniques employed to define and obtain essential functions of component parts of products at lowest manufacturing cost. Human relations aspects are stressed. Case histories of savings illustrated.	Nov	176
Integration of Systems Engineering with Component Development, J. A. Morton New directions in electronic component development are discussed with special emphasis on the need for starting systems engineering at the component/material level and not only at the circuit level.	Aug	85
Delay Line Design Nomogram, S. D. Coleman, Jr. For lumped-parameter delay lines the various limiting design factors may be conveniently established as a nomogram, which is presented. An example clarifies the use of the design method.	Mar	154
Designing Optimum Inductors with Ferrite-Biased Gaps, J. T. Ludwig Barium ferrite gaps permit up to 78 per cent volume reduction over air-gap designs of iron-cored inductors carrying superposed alternating and direct currents. Analysis and synthesis procedures presented for optimum inductors with iron (Audio A) or ceramic (Ferramic H) cores.	Jan	78
Human Engineering		
Labeling Control-Panel Elements, H. L. Williams Good labels are essential in the design of man-machine systems. The article reviews basic principles and recommended practice to help the engineer select the right labels and to locate them on the panel for ease and accuracy of operation. A check-list of basic points is provided.	Oct	177
Maintainability		
Dependability of Military Equipment: a Systems Approach, J. G. Wohl System design considerations are analyzed as they influence overall equipment dependability or readiness. Dependability is distinguished from, but includes, reliability and maintainability.	Mar	96

Subject Classification	Month	Page
Materials Selection Factors		
Effects of Temperature on Magnetic Core Materials, Michael Pasnak and R. H. Lundsten. Measurements of representative samples of major alloy types over temperature range 24 to 850 C. D-C magnetization curves, initial and maximum permeabilities, plus both a-c and d-c values of "squareness" ratio, remanence, saturation induction, and coercivity of L-Silectron, Transformer-A, 11.7 and 15.5 Alfenol, 3 Mo Thermenol, Supermendur, 7-70 Perminvar, Orthonol, AEM 4750 and 4-79 Mo Permalloy.	Oct	119
Determination of Electrical Resistance of Metal Parts, C. A. Escoffery. A compilation of electrical resistivity characteristics in metallic materials most likely to be used in design. Methods for calculating total resistivity are given. Also presented is a nomogram for calculating total resistance of circular cross-sections of metals.	Sep	108
Clad and Laminated Metals — Their Design Potentials, Staff Report. Presented are examples of areas of application of combined metals. Combinations by cladding and laminating give, for certain applications, a superior product which yields top properties of each constituent metal. Treated in this article are the precious and rare metals, aluminum, steel, copper and molybdenum combinations. Article is illustrated by typical case histories supported by graphs, charts and illustrations.	Jun	78
Molded Polyester Structures in Welding Transformers, P. E. Girton. Welding transformer utilizes glass-polyester construction for high shock resistance of body casting and excellent dielectric properties for prevention of shorting to ground. Design is simplified through molding procedures and entire unit is sealed against external contamination.	Jan	166
Miniaturization		
The Miniature Relay in Great Britain, J. H. Mitchell and L. S. Distin. Design difficulties presented by the multiple requirements for smaller relays to operate reliably in increasingly rigorous environments have been solved by various means in the U. S. and abroad. Outlined here are some of the British solutions and views of the problems.	May	106
Micro-Module Design Progress, Paul G. Jacobs. Significant accomplishments in the Army micro-module program by RCA and other participants. Major achievements described include establishment and refinements of system design including module standards and basic methods of assembly. Preliminary micro-elements, modules and assemblies are illustrated.	Mar	78
Nuclear Radiation Effects		
Effect of High Temperature and Nuclear Radiation on Silicone Insulation Systems, C. G. Currin and F. A. Smith. Silicone electrical insulation is being used increasingly in equipments and devices operating in nuclear environments, frequently under high-temperature conditions. This article details and interprets the results of a program investigating the effects of these environments on several silicone insulation systems.	Oct	110
Nuclear Radiation Effects on Electrical Ceramics, W. E. Rowe and J. R. Johnson. Tabular data covering nature and extent of nuclear radiation damage to ceramic materials used in electrical applications. Background information provides basic definitions of nuclear radiation, lists electrical ceramics, and cites their applications.	Aug	93
Behavior of Semiconductor and Magnetic Materials in Radiation Environment, A. Boltax. Theoretical and experimental behavior of several semiconductor and magnetic materials under irradiation. Charts and graphs are presented to illustrate results obtained under specific environmental conditions. Techniques and procedures, with illustrative data, for minimizing and using radiation effects are also presented.	Mar	99
Radiation Effects Data Sheets on Tubes, Resistors, Capacitors, Semiconductors, Staff Report. Tabulated results of a U. S. Air Force investigation of the effect of nuclear radiation on electron tubes, resistors, capacitors, germanium and silicon diodes and germanium and silicon transistors.	Feb	112
Packaging, Electronic		
Standard Modular System for Transistorized Computers, A. H. Johnson. A modular electronic packaging system for computers is described covering component cards, receptacles, contacts and interconnections for optimum equipment performance and maximum manufacturing efficiency and economy.	Nov	133
Packaged Electronic Circuits, A. S. Khouri. Miniaturized printed-circuit assemblies utilize printed capacitors and resistors on ceramic plates with supplementary capacitors where needed. Provision for circuit alignment with active components (tubes, transistors) is also possible.	Oct	164
Engineered Cooling Cuts Equipment Bulk, Allan D. Kraus. Judicious use of properly designed heat exchangers can boost equipment efficiency and permit more compact designs. In addition, skillful extraction of heat or its addition where needed can permit component placement and general latitude in overall design that would be impossible without adequate provision for heat flow. Basic methods of heat-exchanger design are presented, with examples.	Sep	94
Micro-Module Design Progress, Paul G. Jacobs. Significant accomplishments in the Army micro-module program by RCA and other participants. Major achievements described include establishment and refinements of system design including module standards and basic methods of assembly. Preliminary micro-elements, modules and assemblies are illustrated.	Mar	78
Production Cost		
Value Engineering as a Factor in Product Design, B. W. Eades. To enlist the much-needed cooperation of the design engineer, a value engineer explains his work, also the techniques employed to define and obtain essential functions of component parts of products at lowest manufacturing cost. Human relations aspects are stressed. Case histories of savings illustrated.	Nov	176
Radio Noise and Interference		
Controlling Magnetic Field Interference in Wiring, T. H. Herring. A practical and efficient means of determining the proper spacing between circuits to avoid magnetic field interference in complicated wiring systems such as those found on large airplanes. Various figures of merit are calculated for the sensitive and the source circuits and a nomograph provides the unknown spacing value.	Oct	127
Low-Noise, Solid-State Microwave Amplifiers, R. D. Haun, Jr. and T. A. Osial. Basic principles of paramagnetic MASER amplifiers (including ammonia gas, two-level solid-state, three-level solid-state, and optically pumped devices) and parametric MAVAR amplifiers (including semiconductor and ferromagnetic types), plus a brief introduction to the tunnel-diode amplifier.	Oct	139
Reliability		
Dependability of Military Equipment: a Systems Approach, J. G. Wohl. System design considerations are analyzed as	Mar	96

Subject Classification	Month	Page
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Shock and Vibration

Random-Wave Vibration Testing, J. A. Ross A general study of the operation and capabilities of random-wave vibration test equipment, test facilities and test parameters used in the design of electronic equipment operating within a dynamic environment. Procedures by two large testing facilities are described and typical test systems are illustrated. Missiles applications are extrapolated to normal electronics production problems.	Nov	172
The Shock Spectrum: A Means of Stating Mechanical Shock Requirements, Charles T. Morrow A discussion of the shock spectrum as a means of stating shock requirements in environmental specifications in preference to the usual approach of stating acceleration pulse shape. Instrumentation and other considerations involved in this new approach are discussed.	Aug	121
The Fundamental Nature of Shock and Vibration: Theory, Character and Mechanism of Damage, Principles of Testing, I. Vigness Fundamentals of shock and vibration are discussed and analyzed. The basic information is applied to functional engineering problems: design of equipment to withstand these environments, evaluation of specifications, selection of test methods.	Jun	89

Space and Weight Factors

Mechanical Aspects of Control-Center Design, J. L. Defandorf Details of the Unitrol concept of industrial motor control-center design: a modular assembly consisting entirely of standardized components, permits almost unlimited original design flexibility and subsequent in-field changeability for a given control-center installation.	Jul	98

Specifications and Standards

Relay Test Code Advanced, Arnold E. Rudahl Definitions of terminology, discussion of methods, equipment and specifications involved in relay testing have been under intensive study by a committee of the relay industry. A progress report is now ready and available. This report and other relay design and use trends were discussed at the Seventh National Conference on Electromagnetic Relays, summarized here.	Jul	81
Approval of UL Standards as American Standards, Staff Report Although electrical manufacturers as a group have long advocated the conversion of selected Underwriters' Laboratory Standard Requirements for Safety to American Standards, it is only within recent years that those substantially concerned have gone along with the idea. Herein is an analysis of this trend, the motivation behind it, and its influence on product acceptance.	Apr	156

Thermal Design Factors

Inherent Motor Overheat Protection Moves inside the Field Coils, G. P. Gibson, J. J. Courtin and W. H. Elliot Spurred by protection problems raised in polyphase hermetic motor applications where the ratio of full-load to locked-rotor current is low, two solutions to the problem of putting temperature sensors in the stator windings have been found. Both involve semiconductor thermistors, but in opposite modes of operation — as non-linear positive and as negative-temperature-coefficient resistors. Applications to general-purpose squirrel-cage motors are in the offing.	Nov	125
Effect of High Temperature and Nuclear Radiation on Silicone Insulation Systems, C. G. Currin and F. A. Smith Silicone electrical insulation is being used increasingly in equipments and devices operating in nuclear environments, frequently under high-temperature conditions. This article details and interprets the results of a program investigating the effects of these environments on several silicone insulation systems.	Oct	110
Effects of Temperature on Magnetic Core Materials, Michael Pasnak and R. H. Lundsten Measurements of representative samples of major alloy types over temperature range 24 to 850 C. D-C magnetization curves, initial and maximum permeabilities, plus both a-c and d-c values of "squareness" ratio, remanence, saturation induction, and coercivity of L-Silectron, Transformer-A, 11.7 and 15.5 Alfenol, 3 Mo Thermenol, Supermendur, 7-70 Permimvar, Orthonol, AEM 4750 and 4-79 Mo Permalloy.	Oct	119
Engineered Cooling Cuts Equipment Bulk, Allan D. Kraus Judicious use of properly designed heat exchangers can boost equipment efficiency and permit more compact designs. In addition, skillful extraction of heat or its addition where needed can permit component placement and general latitude in overall design that would be impossible without adequate provision for heat flow. Basic methods of heat-exchanger design are presented, with examples.	Sep	94
Fluorochemical-Vapor Cooling Techniques in Electronic Equipment, L. F. Kilham, R. R. Ursch and J. F. Ahearn A study of fluorochemical vapors used as dielectric and heat-transfer materials. The properties of these materials are discussed, different types of cooling systems and special design parameters for use of fluorochemical vapors in electronic equipment are presented. Supporting data in the form of charts, tables and mathematical formulae are given.	Aug	88
Air Filters for Electronic Equipment, T. G. Nessler The selection and application of mechanical air filters for use in the cooling systems of electronic equipment, particularly as applied to military equipment. Various types (viscous impingement, electrostatic and dry) are described and their characteristics enumerated.	Aug	128
Design Plan for Forced-Air Cooling, T. C. Reeves A 1-2-3 plan for determining the necessary cooling apparatus required for electronic equipment. Includes definite provisions for ascertaining that the cooling will be sufficient to meet reliability design goals but will not be extravagant.	Jun	63
Heat Flow Theory, A. D. Kraus Derivations of the basic equations for conduction, convection and radiation; combined effects. Use of dimensional analysis to establish the parameters and the various "numbers" involved in convection expressions. Solutions of empirical equations using simulated experimental data. Transistor heat-transfer case history.	Apr	123
New Hotter Motors Demand Thermal Protection, V. G. Vaughan and A. P. White New, higher temperature limits permitted by revised Underwriters' requirements impose an even greater need for appliance-motor thermal protection. Higher temperature effects on insulation life expectancy also make temperature measurement methods a more critical question. Both aspects of the new regulations are discussed in detail.	Feb	108

DRIVES

Electrical

Current-Controlled D-C Motor Drive, E. H. Dinger An analysis of the functioning principles of a versatile d-c motor drive employing armature	Aug	78

Subject Classification	Month	Page
and field current control by thyratrons and ignitrons. Advantages of the system, its operating characteristics, and application data for particular drive requirements are presented.		
Machine Tool Forum Tackles Design Problems, Staff Report	Jun	116
A report of the 23rd Westinghouse Machine Tool Forum. General trends evidenced during the sessions are discussed and selected papers summarized. The latter include those on variable-speed drives, new components, and machine control systems.		
The "S-Generator" Metadyne for High-Performance D-C Drives, William Arrott	May	92
Design, operation and performance of the constant-current S-generator metadyne developed by the Louis Allis Co. to improve system performance and minimize control hardware for rapid-reversing, adjustable-speed d-c drives. Initial applications: high-speed planers and radar antennas, in place of conventional m-g set shunt generator.		
Load Factors in Selection of Eddy-Current Drives, R. P. Bleikamp	Apr	92
Eddy-current couplings and brakes can develop torque only while slipping, and their power ratings are largely determined by their thermal capacities. These primary properties are shown to be the keys to application of eddy-current drive devices. Characteristic curves and specific drive application examples are presented.		
Mechanical		
The Case for Pump Servos in Machine Drive and Control Systems, William Arrott	Dec	158
The general applicability of variable-displacement pumps for applications over 10 hp is established by the design considerations that led Minneapolis-Honeywell engineers to select pump servos for the two 2-axis tracer controls (22.5 hp per axis) and 200-hp spindle drive of a large Hufford spin-forge machine.		
Constant-Speed Drive for Airliner A-C System, Staff Report	Apr	165
The recognized advantages of a-c electrical systems for aircraft are achieved by the use of engine-powered hydraulic constant-speed drives and brushless generators. The combination as applied in the Boeing 707 airliner is described.		
GENERATORS		
Power		
The "S-Generator" Metadyne for High-Performance D-C Drives, William Arrott	May	92
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Diodes are used in a new system for voltage regulation of a-c generators that employ rotating exciters. Efficiency and fast response are obtained in a low-cost and compact regulator. Circuits and test data support the detailed description.		
INSTRUMENTS AND TEST EQUIPMENT		
Applications		
Electrical Spectrum Analysis, R. Saul and E. L. Luloff	Jul	125
Analysis of the spectrum of an electrical wave is described mathematically by the use of Fourier mathematics and by an instrument, the spectrum analyzer. Theory of operation of this instrument is presented fully, supported by graphical treatment.		
Design		
Automatic Circuit Analyzer Programs Its Own Tests, Kurt Enslein and H. J. Kirschnick	Nov	106
Design details of first-of-its-kind analyzer that analyzes terminal-to-terminal continuity of prototype cable harnesses and electrical/electronic equipments and prepares both a printed tape for comparison with design specifications and a punched tape for programming its own leakage and continuity tests on subsequent production models. Identifies kind and location of errors.		
Overspeed-Overtorque Detection by Pulse Timing, M. E. Fitch	Jun	84
A unique pulse-timing method is used to provide control of speed and torque in a system for testing high-speed (110,000 rpm) components such as bearings and shaft seals.		
Transistors Demonstrate Reliability in Critical Nuclear Instrumentation, R. F. Shea	May	111
Applications of transistor d-c amplifiers in nuclear reactor instrumentation and control where reliability is paramount from a safety point of view. Included in this discussion are differential amplifiers, chopper-modulated amplifiers, diode-ring modulators, and conventional direct-coupled amplifiers.		
Meter Indicates Diode Recovery Time, R. Fekete	Feb	103
A meter technique for diode reverse recovery time measurement eliminates the need for an oscilloscope. The system can be used for other transient response measurements. The article describes the overall measuring system, including pulse generator, recovery circuits, wideband amplifier, cathode follower, voltage comparator circuits and metering circuits. Three typical voltage comparator circuits are analyzed in detail.		
MATERIALS, ELECTRICAL/ELECTRONIC		
European Developments in Electronic Components, G. W. A. Dummer	Jan	131
Survey of current developments in Europe in electronic components and basic electronic materials covers contributions from Great Britain, France, Holland, Norway, Switzerland and Germany. Details are given on capacitors, resistors, potentiometers, batteries, magnetic and dielectric materials, among other items.		
Conductor Materials		
Silver and Silver Alloys — Properties and Design Applications, C. H. Chatfield	Oct	167
The physical and electrical properties of silver are described and illustrated with their effects on design of electrical and electronic equipment. Electrical conductivity, corrosion resistance, fabricability and reliability are explained and supported by charts and tables. Applications of silver in equipment design are illustrated.		
Determination of Electrical Resistance of Metal Parts, C. A. Escoffery	Sep	108
A compilation of electrical resistivity characteristics in metallic materials most likely to be used in design. Methods for calculating total resistivity are given. Also presented is a nomogram for calculating total resistance of circular cross-sections of metals.		
Key to Metals in Design Engineering, S. H. Avner and H. E. Barkan	May	123
Basic principles of metallurgy are presented. Structural characteristics of metals are explained and related to design concepts. Physical and mechanical properties of metals are defined and illustrated by tables and charts. The nature and specifications of metals are de-		

Subject Classification	Month	Page
tailed for better understanding of current literature. The effects of environment and mechanisms of damage are shown and illustrated.		
Behavior of Semiconductor and Magnetic Materials in Radiation Environment, A. Boltax Theoretical and experimental behavior of several semiconductor and magnetic materials under irradiation. Charts and graphs are presented to illustrate results obtained under specific environmental conditions. Techniques and procedures, with illustrative data, for minimizing and using radiation effects are also presented.	Mar	90
Contact Materials		
Contact Research Expanded, Staff Report A report on the recent Engineering Seminar on Electrical Contacts held at Pennsylvania State University, with summaries of some of the technical papers presented. Test methods and circuits and analyses of the mechanics of contact operation are included.	Aug	132
Electrical Insulation and Dielectrics		
High-Potential Tests for Aircraft and Missile Electrical Insulation, L. B. Kilman and J. P. Dallas MIL specifications now require 1500-volt, 60-cycle, 1-min high-potential tests of 28-volt aircraft and missile electrical equipment. These tests are also recommended by AIEE Test Code No. 803. The pros and cons of these tests are reviewed, test procedures described, and test data on repeated tests (previously unreported) are summarized for commercially available mica, Mylar polyester film, fish paper and TFE-fluorocarbon tape.	Dec	124
Evaluation of Open-Enclosure Epoxy-Sealed Motors, V. B. Honsinger Results of environmental tests on open-enclosure epoxy-resin sealed motors designed for use under conditions where standard enclosed and protected motors are normally used.	Nov	114
Effect of High Temperature and Nuclear Radiation on Silicone Insulation Systems, C. G. Currin and F. A. Smith Silicone electrical insulation is being used increasingly in equipments and devices operating in nuclear environments, frequently under high-temperature conditions. This article details and interprets the results of a program investigating the effects of these environments on several silicone insulation systems.	Oct	110
Effects of Thermal Environment on Laminated Plastics, S. W. Place The effects of heat and moisture on the dimensional stability and mechanical and electrical characteristics of thermosetting laminates are correlated in relation to various test methods. Material is based on property evaluations and standards by ASTM, NEMA and Johns Hopkins University. A partial list of ASTM test methods most frequently used in evaluation of laminated plastics is also given.	Sep	145
R & D Progress in Ultrahigh-Temperature Dielectric Materials, L. E. Sieffert Progress in the Navy Department's Bureau of Ships R & D contracts for various dielectric materials for ultrahigh-temperature (also nuclear-radiation) service. Report includes data on embedding and potting compounds, capacitor dielectrics, r-f cable insulation and magnet wire.	Sep	148
Nuclear Radiation Effects on Electrical Ceramics, W. E. Rowe and J. R. Johnson Tabular data covering nature and extent of nuclear radiation damage to ceramic materials used in electrical applications. Background information provides basic definitions of nuclear radiation, lists electrical ceramics, and cites their applications.	Aug	93
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The Fundamental Properties of Plastics, T. D. Callinan and A. E. Javitz The fundamental science of polymers is discussed and related to the engineering properties of plastics materials. The article explains the basic molecular structures, the chemistry of polymerization, and the effect of electron forces. The theoretical basis for mechanical, electrical and chemical properties is developed with pertinent examples.	Aug	105
Flame-Resistant Glass-Polyester Laminates, H. R. Sheppard A study of flame resistance and tracking resistance of glass-polyester materials, with emphasis on applications in switch-gear design. Tables are given that define physical properties of these materials. Indications of useful types of glass-polyesters are also presented.	Jul	122
Dielectric Requirements in Microwave Equipment, C. L. Petze, Jr. The primary considerations in selection of dielectric materials for microwave applications are discussed. A family of silicone alloys with controllable properties has been developed. Characteristics and design case histories are given.	Jul	128
Protective Coatings for Missile Printed Circuits, A. E. Hawley and W. E. Weber This report provides data on the formulation and characteristics of several coatings specially developed for the exacting requirements of printed circuits in missile electronic systems. Test procedures are also detailed.	Jun	58
Pressure-Sensitive Electrical Tapes as Designed-In Components, W. M. Hanson Pressure-sensitive electrical tapes are considered as designed-in components. The effect of tape materials on properties is discussed. New developments in backings and adhesives are stressed. Applications are shown.	Jun	124
How to Specify Insulating Varnishes for Equipment Reliability, D. L. McClenahan Insulating varnishes are reviewed and classified as key components in electrical insulation systems for maximum equipment life and reliability. Data are provided on major types of varnishes, their respective characteristics, compatibility, application methods and best areas of application.	May	100
Explosion-Proof Mine Transformer-Insulation System, J. Debaise Analysis of several alternate electrical-insulation systems for Belgian mine transformers required to be explosion proof under firedamp conditions, to be light in weight and to have adequate mobility. Test data are given on a Class H type finally selected.	May	158
High-Temperature Characteristics of Thermosetting Laminates, Staff Report Results and discussion of tests on commercial thermosetting laminates conducted at the Johns Hopkins University under NEMA sponsorship. Tests were made at temperatures up to 250 C to determine optimum application areas.	Apr	115
Design Characteristics of Hard-Anodize on Aluminum, J. Collins Anodic films possess an effective combination of good electric strength and extremely efficient environmental protection. This article presents design parameters and illustrative case histories of anodized parts. Design concepts are illustrated by tables and photographs in support of the text.	Apr	161
Functional Evaluation of Motorette Insulation Systems, E. L. Brancato and L. M. Johnson Thirteen motorette insulation systems (classes A, B and H) have been evaluated by the U. S.	Mar	146

Subject Classification	Month	Page
Naval Research Laboratory as a basis for design of Bureau of Ships motors. Test data are presented and analyzed covering aging characteristics and system life.		
Research Progress in Dielectrics — 1958, Alex E. Javitz Twelfth annual staff review of the contributed and invited papers, also of the round-table discussions, at the 1958 meeting of the National Academy of Sciences — National Research Council Conference on Electrical Insulation. Papers emphasized detailed studies of corona effects on insulation, high-temperature insulation systems, nuclear radiation effects, and the relation between molecular configuration and electrical characteristics of materials.	Jan	91
Molded Polyester Structures in Welding Transformers, P. E. Girton Welding transformer utilizes glass-polyester construction for high shock resistance of body casting and excellent dielectric properties for prevention of shorting to ground. Design is simplified through molding procedures and entire unit is sealed against external contamination.	Jan	166
Magnetic Materials		
Effects of Temperature on A-C Magnetic Properties of Nickel-Iron Alloys, J. J. Clark and J. F. Fritz A report on the second half of a two-part study to provide design data for developmental magnetic devices and temperature compensation parameters for existing applications. Results are reported in form of curves for 60, 400, and 1000 cps describing variation of core loss and rms exciting volt-amperes per unit of weight as temperature varies. Six alloys are reported for the temperature range —60 to +250 C.	Dec	152
Effects of Temperature on Magnetic Core Materials, Michael Pasnak and R. H. Lundsten Measurements of representative samples of major alloy types over temperature range 24 to 850 C. D-C magnetization curves, initial and maximum permeabilities, plus both a-c and d-c values of "squareness" ratio, remanence, saturation induction, and coercivity of L-Silectron, Transformer-A, 11.7 and 15.5 Alfenol, 3 Mo Thermenol, Supermendur, 7-70 Perminvar, Orthonol, AEM 4750 and 4-79 Mo Permalloy.	Oct	119
R-F Measurements on Ferrite Cores, P. P. Lombardini and R. F. Schwartz A study is presented of several effective means of making measurements at frequencies from 2½ to 30 mc of the relative permeability and quality factor, Q, of ferrite ring samples ranging in size from ¾ to 2⅝ in. diam. In addition to the r-f bridge and Q-meter techniques, theory of measurement by resonance and impedance methods using a cavity-inductor is included, also measurements under conditions of static and dynamic bias. Measurement of dielectric properties also presents problems.	Apr	148
Behavior of Semiconductor and Magnetic Materials in Radiation Environment, A. Boltax Theoretical and experimental behavior of several semiconductor and magnetic materials under irradiation. Charts and graphs are presented to illustrate results obtained under specific environmental conditions. Techniques and procedures, with illustrative data, for minimizing and using radiation effects are also presented.	Mar	90
Hysteresis Torque Limits Lifted with New Magnetic Alloy, J. C. Betts The magnetic and physical properties of a new carbon-free magnet alloy are detailed and compared with other alloys, specifically in relation to use in hysteresis torque devices. Data curves and tables support the analytical discussions.	Mar	101
Fundamentals of Ferromagnetism, A. Arrott and J. E. Goldman This new approach to the study of magnetism is derived from modern solid-state physics and uses the interactions of electrons to explain the basic types of magnetic "motion" (uniform rotation of magnetization, curling and domain wall movement) and the properties of soft magnetic alloys, ferrites and permanent magnet materials.	Mar	109
New Developments in Magnetic Materials and Applications, William Arrott The design significance of research progress reported at the 1958 AIEE Conference on Magnetism and Magnetic Materials for: computer elements, microwave components, permanent magnets, soft magnetic alloys, and new magnetic devices.	Feb	56
MATERIALS, MECHANICAL/STRUCTURAL		
Composite Materials		
Clad and Laminated Metals — Their Design Potentials, Staff Report Presented are examples of areas of application of combined metals. Combinations by cladding and laminating give, for certain applications, a superior product which yields top properties of each constituent metal. Treated in this article are the precious and rare metals, aluminum, steel, copper and molybdenum combinations. Article is illustrated by typical case histories supported by graphs, charts and illustrations.	Jun	78
Metals		
Aluminum — Its Electromechanical Function in Design, Staff Report A report on electromechanical properties of aluminum and its alloys in design of electrical components and equipment. The interrelation of properties, design and applications is developed from material supplied by the Aluminum Company of America. The effects of corrosion, joining problems, fabrication, selection of alloys, thermal properties — and others — on design are integrated with current applications and research and development projects.	Dec	114
Beryllium — The Metal and Its Design Potential, F. M. Yans and N. R. Gardner The properties and applications of beryllium and its alloys are reviewed. Physical, thermal, electrical, optical and nuclear properties are detailed and projected into design considerations. Design parameters are explored and expanded with the aid of charts, tables and graphs.	Nov	181
Silver and Silver Alloys — Properties and Design Applications, C. H. Chatfield The physical and electrical properties of silver are described and illustrated with their effects on design of electrical and electronic equipment. Electrical conductivity, corrosion resistance, fabricability and reliability are explained and supported by charts and tables. Applications of silver in equipment design are illustrated.	Oct	167
Clad and Laminated Metals — Their Design Potentials, Staff Report Presented are examples of areas of application of combined metals. Combinations by cladding and laminating give, for certain applications, a superior product which yields top properties of each constituent metal. Treated in this article are the precious and rare metals, aluminum, steel, copper and molybdenum combinations. Article is illustrated by typical case histories supported by graphs, charts and illustrations.	Jun	78
Key to Metals in Design Engineering, S. H. Avner and H. E. Barkan Basic principles of metallurgy are presented. Structural characteristics of metals are explained and related to design concepts. Physical and mechanical properties of metals are defined and illustrated by tables and charts. The nature and specifications of metals are detailed for better understanding of current literature. The effects of environment and mechanisms of damage are shown and illustrated.	May	123

Subject Classification | Month | Page

Non-metallic Materials

The Fundamental Properties of Plastics, T. D. Callinan and A. E. Javitz — Aug — 105
The fundamental science of polymers is discussed and related to the engineering properties of plastics materials. The article explains the basic molecular structures, the chemistry of polymerization, and the effect of electron forces. The theoretical basis for mechanical, electrical and chemical properties is developed with pertinent examples.

Protective Coatings

Military Specifications for Ball-Bearing Lubricants, H. Villaume — Dec — 128
Selected lubricating oils and greases for high- and low-temperature operation of ball bearings in electronic equipment are described from military specifications. Properties, characteristics, operating conditions and sources of supply are listed. Supported by charts and graphs detailing special conditions and materials.

Design Characteristics of Hard-Anodize on Aluminum, J. Collins — Apr — 161
Anodic films possess an effective combination of good electric strength and extremely efficient environmental protection. This article presents design parameters and illustrative case histories of anodized parts. Design concepts are illustrated by tables and photographs in support of the text.

MOTORS

Fractional-Horsepower

Service Conditions in Motor-Protector Selection, A. P. White — Dec — 164
With the increase in automatic control, motors are exposed to more complex service cycles and arduous ambients. This fact, and the present practice of applying thermal protectors up to the maximum allowable limit of temperature rise, makes it necessary that the protectors be selected for particular service. Service conditions and methods of significant testing for protector selection are related.

Circuit Factors in Motor Protection, H. J. Wilt — Jun — 66
In selecting and applying protective devices for machine and equipment drive motors, the protected motor or other load is only one factor to be considered. The various possible arrangements of protective devices and the important power-circuit aspects that must be analyzed for adequate and efficient short-circuit and overload protection are discussed.

New Hotter Motors Demand Thermal Protection, V. G. Vaughan and A. P. White — Feb — 108
New, higher temperature limits permitted by revised Underwriters' requirements impose an even greater need for appliance-motor thermal protection. Higher temperature effects on insulation life expectancy also make temperature measurement methods a more critical question. Both aspects of the new regulations are discussed in detail.

Integral-Horsepower

Inherent Motor Overheat Protection Moves inside the Field Coils, G. P. Gibson, J. J. Courtin and W. H. Elliot — Nov — 125
Spurred by protection problems raised in polyphase hermetic motor applications where the ratio of full-load to locked-rotor current is low, two solutions to the problem of putting temperature sensors in the stator windings have been found. Both involve semiconductor thermistors, but in opposite modes of operation — as non-linear positive and as negative-temperature-coefficient resistors. Applications to general-purpose squirrel-cage motors are in the offing.

Current-Controlled D-C Motor Drive, E. H. Dinger — Aug — 78
An analysis of the functioning principles of a versatile d-c motor drive employing armature and field current control by thyratrons and ignitrons. Advantages of the system, its operating characteristics, and application data for particular drive requirements are presented.

Special

D-C Torque Motors for Servo Applications, D. G. O'Brien — Jul — 76
The torque motor, an electromagnetic transducer, has grown rapidly in the last few years in the variety and number of its applications in servo systems. The theory of its operation (including development of its frequency response) and information necessary to its correct application are given.

Unique Operating Characteristics Offered by Printed-Circuit Motor, J. Henry-Baudot and R. P. Burr — May — 116
Practical development of the principle of printing the windings of d-c motors has led to a new basic motor design that offers many advantages for both control and power uses. Typical motor performance, design details and application factors are outlined.

Hysteresis Torque Limits Lifted With New Magnetic Alloy, J. C. Betts — Mar — 101
The magnetic and physical properties of a new carbon-free magnet alloy are detailed and compared with other alloys, specifically in relation to use in hysteresis torque devices. Data curves and tables support the analytical discussions.

Gearless Drive for Power Servo, E. B. Canfield — Jan — 142
A detailed, technical description of a new approach to the design of power drives for use in high-performance servo applications. Backlash and resonance difficulties are avoided by the elimination of gearing between the drive motor, the load, and the response element: i.e., the motor is actually built in, as part of the load, and rotates at the same speed as the load.

PRODUCTION AND ASSEMBLY TECHNIQUES

Printed Wiring

Unique Operating Characteristics Offered by Printed-Circuit Motor, J. Henry-Baudot and R. P. Burr — May — 116
Practical development of the principle of printing the windings of d-c motors has led to a new basic motor design that offers many advantages for both control and power uses. Typical motor performance, design details and application factors are outlined.

Applique Wiring, J. D. Lewis and T. D. Schlabach — Feb — 72
Description of a new "printed" wiring process which uses a circuit pattern stamped or "dinked" from metal foil and then applied to the surface of an insulator base material. Performance advantages derive from the absence of contaminants since etchants are not required and higher insulation resistance is achieved because no adhesive exists on the insulator surface between conductors.

Soldering and Solderless Techniques

Materials and Techniques for High-Temperature Electrical Connections, D. W. Herold — Dec — 111
A review of available soldering materials and techniques suitable for high-temperature connections. Also discussed are methods for making mechanical connections, brazing and welding.

TESTING

Components

Tests for Smooth-Running Rolling-Contact Bearings, T. W. Morrison and T. Tallian — Jul — 100
To overcome misleading comparative ear tests for noisy bearings, a method of vibration testing using spectrum analysis is described. Correlation is made with quiet motors. Other objective tests apply to spindle bearings. Tells what the manufacturer can do to measure and control waviness in surfaces of bearing parts.

Subject Classification	Month	Page
found to be the chief cause of noise and vibration.		
Realistic Temperature-Power Derating Requirements for Carbon-Composition Resistors, J. L. Easterday and H. Braner The results of a Signal Corps-sponsored program to develop more realistic derating curves for carbon-composition resistors. Two methods have been developed for the component application engineer. The first method shows degradation of the resistor at high temperature in terms of the deviation of the resistance from the initial value as a function of load for a life of 2000 hr; the second indicates derating requirements for a maximum of 20 per cent resistance deviation from normal during 2000-hr life.	Mar	141
Meter Indicates Diode Recovery Time, R. Fekete A meter technique for diode reverse recovery time measurement eleminates the need for an oscilloscope. The system can be used for other transient response measurements. The article describes the overall measuring system, including pulse generator, recovery circuits, wideband amplifier, cathode follower, voltage comparator circuits and metering circuits. Three typical voltage comparator circuits are analyzed in detail.	Feb	103
Environmental		
Evaluation of Open-Enclosure Epoxy-Sealed Motors, V. B. Honsinger Results of environmental tests on open-enclosure epoxy-resin sealed motors designed for use under conditions where standard enclosed and protected motors are normally used.	Nov	114
Random-Wave Vibration Testing, J. A. Ross A general study of the operation and capabilities of random-wave vibration test equipment, test facilities and test parameters used in the design of electronic equipment operating within a dynamic environment. Procedures by two large testing facilities are described and typical test systems are illustrated. Missiles applications are extrapolated to normal electronics production problems.	Nov	172
The Shock Spectrum: A Means of Stating Mechanical Shock Requirements, Charles T. Morrow A discussion of the shock spectrum as a means of stating shock requirements in environmental specifications in preference to the usual approach of stating acceleration pulse shape. Instrumentation and other considerations involved in this new approach are discussed.	Aug	121
Materials		
High-Potential Tests for Aircraft and Missile Electrical Insulation, L. B. Kilman and J. P. Dallas MIL specifications now require 1500-volt, 60-cycle, 1-min high-potential tests of 28-volt aircraft and missile electrical equipment. These tests are also recommended by AIEE Test Code No. 803. The pros and cons of these tests are reviewed, test procedures described, and test data on repeated tests (previously unreported) are summarized for commercially available mica, Mylar polyester film, fish paper and TFE-fluorocarbon tape.	Dec	124
Effects of Thermal Environment on Laminated Plastics, S. W. Place The effects of heat and moisture on the dimensional stability and mechanical and electrical characteristics of thermosetting laminates are correlated in relation to various test methods. Material is based on property evaluations and standards by ASTM, NEMA and Johns Hopkins University. A partial list of ASTM test methods most frequently used in evaluation of laminated plastics is also given.	Sep	145
R-F Measurements on Ferrite Cores, P. P. Lombardini and R. F. Schwartz A study is presented of several effective means of making measurements at frequencies from 2½ to 30 mc of the relative permeability and quality factor, Q, of ferrite ring samples ranging in size from ¾ to 2⅝ in. diam. In addition to the r-f bridge and Q-meter techniques, theory of measurement by resonance and impedance methods using a cavity-inductor is included, also measurements under conditions of static and dynamic bias. Measurement of dielectric properties also presents problems.	Apr	148
Functional Evaluation of Motorette Insulation Systems, E. L. Brancato, L. M. Johnson and H. P. Walker Thirteen motorette insulation systems (classes A, B and H) have been evaluated by the U. S. Naval Research Laboratory as a basis for design of Bureau of Ships motors. Test data are presented and analyzed covering aging characteristics and system life.	Mar	146
Systems		
Electrical Spectrum Analysis, R. Saul and E. L. Luloff Analysis of the spectrum of an electrical wave is described mathematically by the use of Fourier mathematics and by an instrument, the spectrum analyzer. Theory of operation of this instrument is presented fully, supported by graphical treatment.	Jul	125

Research Notes

	Month	Page
New Extreme-Temperature Silicone Encapsulant	Jan	10
Ceramic-Phenolic Materials with Metal-Matching Coefficients of Linear Expansion	Feb	10
Electro Fluids for Power Transmission	Feb	11
Industry Utilization of Government R & D	Feb	12
Ceramic Ferroelectrics for Digital Storage	Mar	10
MgO in Cold-Cathode Vacuum Tube	Mar	12
Current Trends and Viewpoints in Dielectrics—I	Apr	10
Gamma Radiation Used to Change Design Properties of Plastics	Apr	12
Two New Developments in Polyethylene	May	10
Recent High-K Capacitor Developments in France	May	12
The Impact Strength of "Tough" Plastics	Jun	10
Relationship of the Design Function to Materials Engineering	Jun	12
Current Trends and Viewpoints in Dielectrics—II	Jul	10
The "Tecnetron"—A Germanium Micro-Amplifier	Jul	11
Ultrasonic Image Camera	Aug	10
Electrical Tracking Testing	Sep	10
Transistorized Fourier Transform Generator	Sep	11
International Standards on Creepage and Clearance Distances	Sep	12
Enameled Magnet-Wire Resistance to Short-Time Thermal Overloads	Oct	11
High-Speed Digital Plotter	Oct	12
Breakdown of Plastics Insulation by Gaseous Discharges	Nov	10
A Photochromic Memory Element	Nov	11
Current Trends and Viewpoints in Dielectrics—III	Nov	12
Ceramic Mirrors for Infrared Optical Systems	Dec	11
Predictability Techniques in Selection of Basic Radome Materials	Dec	11

Editorials

	Month	Page
Toward a Philosophy of Technical Publishing	Jan	77
Keeping Things in Perspective	Feb	55
Design for a Small World—the *Real* Challenge	Mar	77
Whither Numerical Control?	Apr	91
An Infinite Capacity	May	91
Fewer—and Better—Technical Meetings!	Jun	57
Fact or Fad in Components and Materials?	Jul	75
Fulfilling the Need to Know	Aug	73
Servo Systems Design	Sep	93
Your Time and Our Space	Oct	109
Materials Research and Design Engineering	Nov	105
NEMA to Expand by Fission	Dec	101

Design Trends

January 1959

	Page
Dual Power Source System Speeds Regulation Response	156
Molded Nylon Blocks for New Patchcord Programming System	157
Random-Access Store	158
Close Temperature and Humidity Control by Time Proportioning	160
Modular Word-Indicating Light	164
Molded Polyester Structures in Welding Transformers	166
Oil-Impregnated Bearing Retainers	168

February 1959

Fine-Wire Tension Safely Measured and Controlled	128
Glass-Reinforced Polyester for Arc-Quenching Service	129
Printed-Circuit Rotary Switch	130
Tiny Die Casting in Computer Programming Plug	132
New Connector Solves Problem in Atomic Hot Cell	134
Urethane Foam Protects Missile Instruments	134
Dynamometer Includes Speed and Starting Torque Measurement	136
Chart for Power-Factor Capacitor Selection	138
Potentiometer Uses Metal Winding-Card	140

March 1959

Delay Line Design Nomogram	154
Missile Control "Bread Board" Trainers	155
Silicon Rectifier Power Drives	156
Slotted Laminate Guides Spring Movement in Aircraft Lightning Arrester	158
Wire Tension Control Speeds Insulation Extrusion	160
Transistor Speed Control in Miniature D-C Motor	160
Hydraulic Power from Electric Source	162
Thermistor Bridge in Flexible Air Temperature Control	162
Taped Data Controls Steel Shape Cutting	164
Precision D-C Pulse Timer	166
Molded Polyester Structures in Welding Transformers	166

April 1959

Automatic High-Speed Screen Printer for Printed-Circuit Applications	164
Constant-Speed Drive for Airliner A-C System	165
Adjustable Nonlinear Function Generator	166
Magnetic Readout in Shaft-Digital Encoder	168
3-D Controlled Electromagnetic Support	170
Optical Measurement Defines Commutator Skew	172
Aluminum Welded Transformer Cases	172
Taut-Band Suspension in New Meter Design	174
Switch Improved with One-Piece Molded Button	174
Flutes Lock Plastic Parts against Shock and Vibration	176

May 1959

High-Performance Fan Engineered for Low Cost	172
Silicon Units Replace Mercury-Vapor Rectifiers	173
Evaporative-Gravity Cooling for a High-Voltage Resistor Package	173
Electrochemical Method of Part Marking	174
Electromagnetic Field Powers Self-Identifying Remote "Transmitter"	176
Knurl-and-Groove Design Improves Miniature Gear and Link Assembly	178
Recording Head with D-C Response	180
Adhesive-Bonded Component Motor	180
Specifying Bobbin Cores for Digital Circuits	182

June 1959

Analog Positioning System Offers Flexible Machine Programming	136
Soldered Connections for Elevated-Temperature Operation	138
Rapid Response in New Altimeter Using Magnetic Transducers and Servo	142
Electronic Tachometer Uses Magnetic Pickup	144

	Page
Electrostatic Microfilm Enlarger-Printer	146
Lighted Pushbutton Monitors Six Conditions	148

July 1959

Servo Integrates Recorder Data	144
Motor Line Includes Sealed Insulation System in New Design	145
Automatic Memory Core Tester	146
Molded Polyester Housing Cuts Size of Speed-Sensing Switches	148
Resolver Compensating Windings Increase Inherent Accuracy	150
Large Eddy-Current Permanent Magnet Torque Devices	152
Comparative Factors of Xenon Thyratrons	154
Standardized Printed-Circuit Board for Experimental Equipment	154
New Casting Process for Miniature Parts	156
Plug-In Ignitron Tube Carrier	156

August 1959

Control Meter with Electronic Link	146
No Ballast or Starter in Fluorescent Lamp	147
Versatile Motor Unit Powers Actuator Line	148
New Form of Brushless Generators, Motors	148
Proximity Coil Protects Punch-Press Dies	150
Instrument Bearings Marked	152
Stainless Steel Improves Reliability	152
Epoxy Embedment of Three-Phase Transformers	154
Molybdenum Disulfide Filled Nylon in Overspeed Governor	154
Pickoff Outputs in Dynamic Testing	156

September 1959

Bellows-Type, Phase-Adjusting Coupling	178
Radar Guidance for Land Vehicles	179
Speed, Torque and Horsepower Nomogram for Low-Speed Geared Motors of 0.00002 to 3 HP	180
Electrochemical Static Control Switches High-Power A-C	182
Glass-Epoxy Copper-Clad Laminate Improves Design of Infrared Equipment	184
Mechanical Amplifier Offers Ruggedness and Sensitivity	186
Multiple Reactor Cores and Windings in Flexible Control System	188

October 1959

Molded DAP Resins in Weapons-System Components Design	180
Tiny Strain Gauges for Rapid Application	182
Wiring Harnesses Machine-Wrapped with Pressure-Sensitive Tape	183
Integrated Design for Compact Airborne Generator	184
Controlled Rectifier Overload Protection	188
Curved Printed-Wiring Boards	188
Protection of Transistor Power-Supply Modules	192
R-C Circuit Equation Solutions	194

November 1959

Unique Seal in Compact Time-Delay Relay	188
R-F Shielding of Fluorescent Lamps	189
Basic Timer for Pushbutton Appliance Control	190
Flexible Magnet Materials for Electronic Equipment	192
Small 400-Cycle Motors Designed to Match Loads	194
Switch Converts Decimal to Binary Digits	196
Ruggedized Miniature Tape Recorder	198
Duty-Cycle Calculations for Wound-Rotor Motors	198

December 1959

Curve Plotting to Test Semiconductors	174
High-Force Thermostatic Actuators	175
Small Emergency Light Plant is Self-Excited	176
Spark Ignites Burner Flame	176
Stepping Transistor for Pulse-Controlled Switching	178
Semiconductor Advances Exploited in Generator Design	180
Control System Representations	182

Authors Index

	Month	Page
A		
Ahearn, J. F.		
Fluorochemical-Vapor Cooling Techniques in Electronic Equipment	Aug	88
Arrott, A.		
Fundamentals of Ferromagnetism	Mar	109
Arrott, W.		
The Case for Pump Servos in Machine Drive and Control Systems	Dec	158
New Developments in Magnetic Materials and Applications	Feb	56
The "S-Generator" Metadyne for High-Performance D-C Drives	May	92
Avner, S. H.		
Key to Metals in Design Engineering	May	123
B		
Barkan, H. E.		
Key to Metals in Design Engineering	May	123
Benham, C. M.		
Metallized Glass-Fiber Resistors—A British Development	Jan	135
Berman, B.		
Static Current and Voltage Control Systems	Nov	157
Betts, J. C.		
Hysteresis Torque Limits Lifted with New Magnetic Alloy	Mar	101
Bleikamp, R. P.		
Load Factors in Selection of Eddy-Current Drives	Apr	92
Boltax, A.		
Behavior of Semiconductor and Magnetic Materials in Radiation Environment	Mar	90
Brancato, E. L.		
Functional Evaluation of Motorette Insulation Systems	Mar	146
Braner, H.		
Realistic Temperature-Power Derating Requirements for Carbon-Composition Resistors	Mar	141
Burr, R. P.		
Unique Operating Characteristics Offered by Printed-Circuit Motor	May	116
C		
Callinan, T. D.		
The Fundamental Properties of Plastics	Aug	105
Canfield, E. B.		
Accelerometers and Their Characteristics	Nov	117
Gearless Drive for Power Servo	Jan	142
Carlson, C. O.		
Sampled-Data Systems	Nov	137
Chatfield, C. H.		
Silver and Silver Alloys—Properties and Design Applications	Oct	167
Clark, J. J.		
Effects of Temperature on A-C Magnetic Properties of Nickel-Iron Alloys	Dec	152
Collins, J.		
Design Characteristics of Hard-Anodize on Aluminum	Apr	161
Courtin, J. J.		
Inherent Motor Overheat Protection Moves Inside the Field Coils: The Westinghouse Solution	Nov	126
Currin, C. G.		
Effect of High Temperature and Nuclear Radiation on Silicone Insulation Systems	Oct	110
D		
Dallas, J. P.		
High-Potential Tests for Aircraft and Missile Electrical Insulation	Dec	124
Debaise, J.		
Explosion-Proof Mine Transformer-Insulation System	May	158
Defandorf, J. L.		
Mechanical Aspects of Control-Center Design	Jul	98
Dick, J. O.		
High-Temperature Capabilities of Germanium Transistors	Jan	149
Dinger, E. H.		
Current-Controlled D-C Motor Drive	Aug	78
Distin, L. S.		
The Miniature Relay in Great Britain	May	106
Douglas, D. M.		
Joint Factors in Stacked Magnetic-Core Design	Sep	117
Duffy, J. J.		
Static Switching Today	May	161
Dummer, G. W. A.		
European Developments in Electronic Components	Jan	131
Metallized Glass-Fiber Resistors—A British Development	Jan	135
Dunigan, F. P.		
Load Control Systems	Apr	120
Durkee, R. W.		
Core Factors in Static Magnetic Switch Performance	Oct	134
E		
Eades, B. W.		
Value Engineering as a Factor in Product Design	Nov	176
Easterday, J. L.		
Realistic Temperature-Power Derating Requirements for Carbon-Composition Resistors	Mar	141
Elliot, W. H.		
Inherent Motor Overheat Protection Moves Inside the Field Coils: The Cutler-Hammer Solution	Nov	130
Enslein, K.		
Automatic Circuit Analyzer Programs Its Own Tests	Nov	106
Escoffery, C. A.		
Determination of Electrical Resistance of Metal Parts	Sep	108
F		
Fekete, R.		
Meter Indicates Diode Reverse Recovery Time	Feb	103
Fenn, R. T.		
Copying Lathe Programmed by Stepping Switches	Mar	86
Fitch, M. E.		
Overspeed-Overtorque Detection by Pulse Timing	Jun	84
Floyd, W.		
Logic-Circuit Modules for Industrial Control Systems	Oct	172
Fritz, J. F.		
Effects of Temperature on A-C Magnetic Properties of Nickel-Iron Alloys	Dec	152
G		
Garbarino, H. L.		
Current-Limiting Power Transformers	Oct	116
Gardner, N. R.		
Beryllium—The Metal and Its Design Potential	Nov	181
Gibson, G. P.		
Inherent Motor Overheat Protection Moves Inside the Field Coils: The Westinghouse Solution	Nov	126
Gilda, D. R.		
Motor-Blower Selection Factors	Nov	166
Goldman, J. E.		
Fundamentals of Ferromagnetism	Mar	109

	Month	Page
Gorten, G.		
Simplifying Servo-System Analysis	Feb	118
Gutzwiller, F. W.		
Overcurrent Protection of Semiconductor Rectifiers	Apr	106
Rectifier Voltage Transients—Causes, Detection, Reduction	Dec	167
H		
Hammerslag, J. G.		
Taking Advantage of the Voltage Sensitivity of the Silicon Capacitor	Sep	172
Hanson, H. M.		
Pressure-Sensitive Electrical Tapes as Designed-In Components	Jun	124
Haun, R. D., Jr.		
Low-Noise, Solid-State Microwave Amplifiers	Oct	139
Hawley, A. E.		
Protective Coatings for Missile Printed Circuits	Jun	58
Henry-Baudot, J.		
Unique Operating Characteristics Offered by Printed-Circuit Motor	May	116
Herold, D. W.		
Materials and Techniques for High-Temperature Electrical Connections	Dec	111
Herring, T. H.		
Controlling Magnetic Field Interference in Wiring	Oct	127
Honsinger, V. B.		
Evaluation of Open-Enclosure Epoxy-Sealed Motors	Nov	114
I		
Irwin, H. A.		
Simplifying Servo-System Analysis	Feb	118
Isborn, C.		
Numerical Controller Uses Magnetic Counters	Jul	93
J		
Jacobs, P. G.		
The Electric Field	Jul	107
Micro-Module Design Progress	Mar	78
Jasper, N.		
Regulation of Airborne Rotating Inverters	Sep	103
Javitz, A. E.		
The Fundamental Properties of Plastics	Aug	105
Research Progress in Dielectrics—1958	Jan	91
Johnson, A. H.		
Standard Modular System for Transistorized Computers	Nov	133
Johnson, J. R.		
Nuclear Radiation Effects on Electrical Ceramics	Aug	93
Johnson, L. M.		
Functional Evaluation of Motorette Insulation Systems	Mar	146
K		
Kececioglu, D. B.		
Construction and Use of Alignment Nomograms	Jun	112
Khouri, A. S.		
Packaged Electronic Circuits	Oct	164
Kilham, L. F.		
Fluorochemical-Vapor Cooling Techniques in Electronic Equipment	Aug	88
Kilman, L. B.		
High-Potential Tests for Aircraft and Missile Electrical Insulation	Dec	124
Kirschnick, H. J.		
Automatic Circuit Analyzer Programs Its Own Tests	Nov	106
Kraus, A. D.		
Design Data Sheets—Equivalent *T* and Pi Networks	Aug	135
Design Data Sheets—Resonant Circuits	Feb	127
Determinants and Matrices	Dec	133
Engineered Cooling Cuts Equipment Bulk	Sep	94
Heat Flow Theory	Apr	123
Kreider, W. J.		
Regulation of Airborne Rotating Inverters	Sep	103
L		
Lermer, A. S.		
A Graphical Analog Computer	Feb	82
Lewis, J. D.		
Applique Wiring	Feb	72
Lindstrom, T.		
Electromagnet Copper-to-Iron Ratio for Optimal Design	Mar	105
Lombardini, P. P.		
R-F Measurements on Ferrite Cores	Apr	148
Ludwig, J. T.		
Designing Optimum Inductors with Ferrite-Biased Gaps	Jan	78
Luloff, E. L.		
Electrical Spectrum Analysis	Jul	125
Lunchick, A.		
Characteristics of Solid Tantalum Capacitors	Jun	74
Lundsten, R. H.		
Effects of Temperature on Magnetic Core Materials	Oct	119
Mc		
McClenahan, D. L.		
How to Specify Insulating Varnishes for Equipment Reliability	May	100
M		
Mager, D. J.		
A Double-Integration Hydraulic Servo	Oct	130
Meyer, C. F.		
The Proximity Limit Switch	Feb	68
Mitchell, J. H.		
The Miniature Relay in Great Britain	May	106
Morrison, T. W.		
Tests for Smooth-Running Rolling-Contact Bearings	Jul	100
Morrow, C. T.		
The Shock Spectrum: A Means of Stating Mechanical Shock Requirements	Aug	121
Morton, J. A.		
Integration of Systems Engineering with Component Development	Aug	85
N		
Nessler, T. G.		
Air Filters for Electronic Equipment	Aug	128
Nothman, M. H.		
Digital Methods in Measurement and Control	Sep	125
O		
O'Brien, D. G.		
D-C Torque Motors for Servo Applications	Jul	76
Oliver, F. J.		
Approval of UL Standards as American Standards	Apr	156
Opperthauser, R. W.		
Construction and Use of Alignment Nomograms	Jun	112
Osial, T. A.		
Low-Noise, Solid-State Microwave Amplifiers	Oct	139
P		
Pasnak, M.		
Effects of Temperature on Magnetic Core Materials	Oct	119
Place, S. W.		
Effects of Thermal Environment on Laminated Plastics	Sep	145
Perout, E. F.		
Standards for Tapping Screws	May	147
Petze, C. L., Jr.		
Dielectric Requirements in Microwave Equipment	Jul	128
Post, R. E., Jr.		
Non-Linear Resistors as Voltage Regulators	Jan	152

	Month	Page
R		
Reeves, T. C.		
Design Plan for Forced-Air Cooling	Jun	63
Ritow, I.		
Automatic Control System Design		
1—Mathematical Techniques—Complex Variables	Apr	99
2—Mathematical Techniques—Laplace Transformations	May	150
3—Frequency Response and Transfer Functions	Jun	129
4—Design by Transfer Function Methods	Jul	134
5—The System Equation	Aug	136
6—Design by Root-Locus	Sep	153
Using Fourier Analysis in Designing Whole Systems, Subsystems, Electrical and Mechanical Devices	Feb	87
Ross, G. F.		
Determinants and Matrices	Dec	133
Ross, J. A.		
Random-Wave Vibration Testing	Nov	172
Rowe, W. E.		
Nuclear Radiation Effects on Electrical Ceramics	Aug	93
Rudahl, A. E.		
Flexible Programming with Optical "Punched" Cards	Jan	100
Relay Test Code Advanced	Jul	81
S		
Saul, R.		
Electrical Spectrum Analysis	Jul	125
Schlabach, T. D.		
Applique Wiring	Feb	72
Schwartz, R. F.		
R-F Measurements on Ferrite Cores	Apr	148
Schwarz, Ruth F.		
Introduction to Semiconductor Theory	Jan	107
Shea, R. F.		
Transistors Demonstrate Reliability in Critical Nuclear Instrumentation	May	111
Sheppard, H. R.		
Flame-Resistant Glass-Polyester Laminates	Jul	122
Sieffert, L. E.		
R & D Progress in Ultrahigh-Temperature Dielectric Materials	Sep	148
Smith, F. A.		
Effect of High Temperature and Nuclear Radiation on Silicone Insulation Systems	Oct	110
Spatz, S.		
Static Switching Today	May	161
Staff Reports (see also under W. Arrott, Barkan, Jacobs, Javitz, Oliver and Rudahl)		
Aluminum—Its Electromechanical Function in Design	Dec	114
Clad and Laminated Metals—Their Design Potentials	Jun	78
Contact Research Expanded	Aug	132
Design Changes Refine Jig Borer Control	Jul	119
1959 Design Engineering Conference and Show	May	170
High-Temperature Characteristics of Thermosetting Laminates	Apr	115
Inherent Motor Overheat Protection Moves Inside the Field Coils	Nov	125
Machine Tool Forum Tackles Design Problems	Jun	116
Magnetic Amplifier Computing Control Circuits	Dec	102
Magnetic-Amplifier Conference Stresses Applications	Dec	149
"Magnistor" Devices for Digital and Logic Circuits	Aug	74
NEMA to Reorganize into Eight Semi-Autonomous Divisions	Dec	131
Positioning Accuracy to 0.01 Inch with Simplified Numerical Control	Aug	98
Radiation Effects Data Sheets on Tubes, Resistors, Capacitors, Semiconductors	Feb	112
The Team Approach in Applying Numerical Control to a Machine Tool	Feb	76
Stratton, L. J.		
Current-Limiting Power Transformers	Oct	116
Stupar, W. E.		
10-Bit Resolution in Shaft-Position to Digital Encoder	Jan	138
T		
Tallian, T.		
Tests for Smooth-Running Rolling-Contact Bearings	Jul	100
U		
Ursch, R. R.		
Fluorochemical-Vapor Cooling Techniques in Electronic Equipment	Aug	88
V		
Vaughan, V. G.		
New Hotter Motors Demand Thermal Protection	Feb	108
Vigness, I.		
The Fundamental Nature of Shock and Vibration: Theory, Character and Mechanism of Damage, Principles of Testing	Jun	89
Villaume, H.		
Military Specifications for Ball-Bearing Lubricants	Dec	128
W		
Walker, H. P.		
Functional Evaluation of Motorette Insulation Systems	Mar	146
Walker, O. A.		
A Double-Integration Hydraulic Servo	Oct	130
Warner, S. D.		
High-Gain Magnetic Amplifier in Bridge Circuit	Sep	114
Weber, L. L.		
Simple Sensing Relay Uses Ferroresonant Circuit	Apr	143
Weber, W. E.		
Protective Coatings for Missile Printed Circuits	Jun	58
Weinstein, W. D.		
The Four-Bar Linkage as a Function Generator	Oct	155
White, A. P.		
New Hotter Motors Demand Thermal Protection	Feb	108
Service Conditions in Motor-Protector Selection	Dec	164
Williams, H. L.		
Labeling Control-Panel Elements	Oct	177
Wilt, H. J.		
Circuit Factors in Motor Protection	Jun	66
Witt, D. R.		
The Model as Design Aid	Jun	109
Wohl, J. G.		
Dependability of Military Equipment: A Systems Approach	Mar	96
Wood, F. W., Jr.		
Instrument Gearhead Application Factors	Feb	122
Y		
Yans, F. M.		
Beryllium—The Metal and Its Design Potential	Nov	181
Z		
Zdzieborski, J.		
Non-Linear Resistors as Voltage Regulators	Jan	152

Alphabetical Subject Cross Index

Subject	Classification
A	
Acoustical Insulation	Materials, Mechanical/Structural (*Thermal and Acoustical Insulation*)
Adhesives	Materials, Mechanical/Structural
Appearance	Design Considerations
Appliance Design	Product Design Case History
Automatic Assembly	Production and Assembly Techniques
B	
Batteries	Components, Electrical/Electronic
Bearings	Components, Mechanical/Structural
Boolean Algebra	Control (*Theory*)
Brushes	Components, Electrical/Electronic (*Contact Devices*)
Business Machines Design	Product Design Case History (*Electronic Apparatus*)
C	
Capacitors	Components, Electrical/Electronic
Casting Resins	Materials, Electrical/Electronic (*Electrical Insulation and Dielectrics*)
Castings	Materials, Mechanical/Structural (*Metals*)
Ceramic Dielectrics	Materials, Electrical/Electronic (*Electrical Insulation and Dielectrics*)
Ceramic-Metals	Materials, Mechanical/Structural (*Composite Materials*)
Cements	Materials, Mechanical/Structural (*Adhesives*)
Circuit Analysis	Circuit Analysis
Circuit Breakers	Components, Electrical/Electronic (*Protective Devices*)
Clad Metals	Materials, Mechanical/Structural (*Metals*)
Coaxial Cable	Components, Electrical/Electronic (*Wire and Cables*)
Color	Design Considerations (*Appearance*)
Commutators	Components, Electrical/Electronic (*Contact Devices*)
Component Design Factors	Design Considerations
Component Failure	Design Considerations (*Reliability*)
Component Testing	Testing
Composite Materials	Materials, Mechanical/Structural
Computer Design	Product Design Case History (*Electronic Apparatus*)
Computers, Design Engineering Applications	Computers
Computers, Systems Applications	Computers
Conductive Plastics	Materials, Electrical/Electronic (*Conductor Materials*)
Conductive Rubber	Materials, Electrical/Electronic (*Conductor Materials*)
Conductor Materials	Materials, Electrical/Electronic
Connections	Production and Assembly Techniques (*Soldering and Solderless Techniques*)
Connectors	Components, Electrical/Electronic (*Wiring Devices*)
Contact Devices	Components, Electrical/Electronic
Contact Materials	Materials, Electrical/Electronic
Control Instruments	Instruments and Test Equipment
Cooling	Design Considerations (*Thermal Design Factors*)
Corona Effects	Testing (*Materials*)
D	
Delay Lines	Components, Electrical/Electronic (*Storage Devices*)
Digital Theory	Control (*Theory*)
Diodes	Components, Electrical/Electronic (*Semiconductor Devices*)
Drive Elements	Drives (*Mechanical*), also Components, Mechanical/Structural
E	
Elastomers	Materials, Mechanical/Structural (*Non-metallic Materials*)
Electrical Drives	Drives
Electrical Insulation and Dielectrics	Materials, Electrical/Electronic
Electrodeposited Coatings	Materials, Mechanical/Structural (*Protective Coatings*)
Electronic Apparatus Design	Product Design Case History
Electron Tubes	Components, Electrical/Electronic
Embedded Circuits and Components	Production and Assembly Techniques
Encapsulation	Production and Assembly Techniques (*Embedded Circuits and Components*)
Engineering Profession	Association and Professional Activities
Engineering Psychology	Design Considerations (*Human Engineering*)
Engineering Salaries	Association and Professional Activities (*Engineering Profession*)
Engineering Shortages	Association and Professional Activities (*Engineering Profession*)
Environmental Effects	Design Considerations (*Reliability*)
Environmental Tests	Testing
Equipment Failure	Design Considerations (*Reliability*)
F	
Fasteners	Components, Mechanical/Structural
Felt	Materials, Mechanical/Structural (*Nonmetallic Materials*)
Ferrites	Materials, Electrical/Electronic (*Magnetic Materials*)
Finishes, Mechanical	Materials, Mechanical/Structural (*Protective Coatings*)
Finishes, Organic	Materials, Mechanical/Structural (*Protective Coatings*)
Flexible Insulation	Materials, Electrical/Electronic (*Electrical Insulation and Dielectrics*)
Fractional-Horsepower Motors	Motors
Fungicidal Treatment	Materials, Mechanical/Structural (*Protective Coatings*)
Fuses	Components, Electrical/Electronic (*Protective Devices*)
G	
Gaseous Dielectrics	Materials, Electrical/Electronic (*Electrical Insulation and Dielectrics*)
Gaskets	Components, Mechanical/Structural (*Seals and Gaskets*)
Gearmotors	Motors (*Special*)
Gears and Pinions	Components, Mechanical/Structural
Glass Dielectrics	Materials, Electrical/Electronic (*Electrical Insulation and Dielectrics*)
H	
Heat Removal	Design Considerations (*Thermal Design Factors*)
Hermetic Sealing	Production and Assembly Techniques
Hookup Wire	Components, Electrical/Electronic (*Wire and Cables*)
Housings	Components, Mechanical/Structural
Human Engineering	Design Considerations
Human Factors	Design Considerations (*Human Engineering*)
Humidity Effects	Testing (*Materials*)
I	
Impregnation	Production and Assembly Techniques (*Embedded Circuits and Components*)
Inductors	Components, Electrical/Electronic (*Magnetic Components*)
Industrial Machinery Design	Product Design Case History
Instrument Applications	Instruments and Test Equipment
Instrument Design	Product Design Case History (*Electronic Apparatus*), also Instruments and Test Equipment (*Design*)
Instrument Generators	Generators (*Instruments*)
Insulation Testing	Testing (*Materials*)
Integral-Horsepower Motors	Motors
International Standards	Design Considerations (*Specifications and Standards*)

Subject	Classification
L	
Laminates, Plastics	Materials, Electrical/Electronic (*Electrical Insulation and Dielectrics*)
Liquid Dielectrics	Materials, Electrical/Electronic (*Electrical Insulation and Dielectrics*)
Lubricants	Materials, Mechanical/Structural (*Non-metallic Materials*)
M	
Magnetic Amplifiers	Control (*Systems and Servos*), also Components, Electrical/Electronic (*Magnetic Components*)
Magnetic Core Memories	Components, Electrical/Electronic (*Storage Devices*)
Magnetic Materials	Materials, Electrical/Electronic
Magnetic Recording	Components, Electrical/Electronic (*Transducers*)
Magnet Wire	Components, Electrical/Electronic (*Wire and Cables*)
Maintainability	Design Considerations
Materials Availability	Design Considerations (*Materials Selection Factors*)
Materials Selection Factors	Design Considerations
Materials System	Design Considerations (*Materials Selection Factors*)
Materials Testing	Testing
Mechanical Drives	Drives
Metallized Parts	Materials, Mechanical/Structural (*Composite Materials*)
Metal-Plastics Sheet	Materials, Mechanical/Structural (*Composite Materials*)
Metals	Materials, Mechanical/Structural
Meters, Panel-Type	Components, Electrical/Electronic
Miniaturization	Design Considerations
Modular Construction	Design Considerations (*Miniaturization*)
N	
NEMA Activities	Association and Professional Activities
Nomographs	Design Considerations
Nonmetallic Materials	Materials, Mechanical/Structural
Nuclear Radiation Effects	Design Considerations
P	
Packaging, Electronic	Design Considerations
Pickups, Electrical	Components, Electrical/Electronic (*Transducers*)
Plastics, Fabricated	Materials, Mechanical/Structural (*Non-metallic Materials*)
Plastics, Insulation	Materials, Electrical/Electronic (*Electrical Insulation and Dielectrics*)
Plastics, Molded	Materials, Mechanical/Structural (*Non-metallic Materials*)
Plated Coatings	Materials, Mechanical/Structural (*Protective Coatings*)
Porcelain Enamel	Materials, Mechanical/Structural (*Protective Coatings*)
Potentiometers	Components, Electrical/Electronic
Potting	Production and Assembly Techniques (*Embedded Circuits and Components*)
Powder Metal Parts	Materials, Mechanical/Structural (*Metals*)
Power Generators	Generators (*Power*)
Printed Circuits	Components, Electrical/Electronic
Printed Wiring	Production and Assembly Techniques
Printed Wiring Board	Components, Electrical/Electronic (*Printed Circuits*)
Production Cost	Design Considerations
Production Tests	Testing
Protective Coatings	Materials, Mechanical/Structural
Protective Devices	Components, Electrical/Electronic
Q	
Quality Control	Testing (*Production*)
R	
Radio Noise and Interference	Design Considerations
Recording Instruments	Instruments and Test Equipment
Rectifiers	Components, Electrical/Electronic (*Semiconductor Devices*)
Relays	Components, Electrical/Electronic (*Magnetic Components*)
Reliability	Design Considerations
Resistance Wire	Materials, Electrical/Electronic (*Conductor Materials*)
Resistors	Components, Electrical/Electronic
Rigid Insulation	Materials, Electrical/Electronic (*Electrical Insulation and Dielectrics*)
S	
Sealants	Materials, Mechanical/Structural (*Adhesives*)
Seals and Gaskets	Components, Mechanical/Structural
Semiconductor Devices	Components, Electrical/Electronic
Sensing Elements	Components, Electrical/Electronic (*Transducers*)
Sheet Metals	Materials, Mechanical/Structural (*Metals*)
Shielding Devices	Components, Electrical/Electronic
Shock and Vibration	Design Considerations
Shock and Vibration Isolators	Components, Mechanical/Structural
Slip Rings	Components, Electrical/Electronic (*Contact Devices*)
Sockets	Components, Electrical/Electronic (*Wiring Devices*)
Soldering and Solderless Techniques	Production and Assembly Techniques
Solenoids	Components, Electrical/Electronic (*Magnetic Components*)
Space and Weight Factors	Design Considerations
Special Motors	Motors
Specifications and Standards	Design Considerations
Springs	Components, Mechanical/Structural
Storage Devices	Components, Electrical/Electronic
Switches	Components, Electrical/Electronic
Systems, Testing	Testing
Systems and Servos	Control
T	
Temperature Limits	Testing (*Materials*)
Terminals	Components, Electrical/Electronic (*Wiring Devices*)
Test Equipment	Instruments and Test Equipment
Theory, Control	Control
Thermal and Acoustical Insulation	Materials, Mechanical/Structural
Thermal Design Factors	Design Considerations
Thermal Dissipation	Design Considerations (*Thermal Design Factors*)
Thermistors	Components, Electrical/Electronic (*Semiconductor Devices*)
Thermostats	Components, Electrical/Electronic (*Transducers*)
Transducers	Components, Electrical/Electronic
Transformers	Components, Electrical/Electronic (*Magnetic Components*)
Transistors	Components, Electrical/Electronic (*Semiconductor Devices*)
TV and Radios	Product Design Case History (*Appliances*)
U	
Unitized Construction	Production and Assembly Techniques
V	
Varnishes, Insulating	Materials, Electrical/Electronic (*Electrical Insulation and Dielectrics*)
W	
Waveguides	Components, Electrical/Electronic (*Wire and Cables*)
Wire and Cables	Components, Electrical/Electronic
Wire Enamel and Insulation	Materials, Electrical/Electronic (*Electrical Insulation and Dielectrics*)
Wiring Devices	Components, Electrical/Electronic
Wiring Harness	Components, Electrical/Electronic (*Wire and Cables*)

Editorial Subject Classification

Association & Professional Activities
- The Engineering Profession
- Joint Industry Conference
- NEMA Activities

Basic Science and Engineering
- Chemistry
- Mathematics
- Physics
- Metallurgy

Circuit Analysis

Components, Electrical/Electronic
- Batteries
- Capacitors
- Contact Devices
- Electron Tubes
- Magnetic Components
- Meters, Panel-type
- Potentiometers
- Printed Circuits
- Protective Devices
- Resistors
- Semiconductor Devices
- Shielding Devices
- Storage Devices
- Switches
- Transducers
- Wire and Cables
- Wiring Devices

Components, Mechanical/Structural
- Bearings
- Drive Elements
- Fasteners
- Gears and Pinions
- Housings
- Seals and Gaskets
- Shock and Vibration Isolators
- Springs

Computers
- Computer Design
- Design Engineering Applications
- Systems Applications

Control
- Case Histories
- Systems and Servos
- Theory

Design Considerations
- Appearance
- Components Design Factors
- Human Engineering
- Maintainability
- Materials Selection Factors
- Miniaturization
- Nomographs
- Nuclear Radiation Effects
- Packaging, Electronic
- Production Cost
- Radio Noise and Interference
- Reliability
- Shock and Vibration
- Space and Weight Factors
- Specifications and Standards
- Thermal Design Factors

Drives
- Electrical
- Mechanical

Generators
- Instruments
- Power

Instruments and Test Equipment
- Applications
- Control
- Design
- Recording

Materials, Electrical/Electronic
- Conductor Materials
- Contact Materials
- Electrical Insulation and Dielectrics
- Magnetic Materials

Materials, Mechanical/Structural
- Adhesives
- Composite Materials
- Metals
- Non-metallic Materials
- Protective Coatings
- Thermal and Acoustical Insulation

Motors
- Fractional-Horsepower
- Integral-Horsepower
- Special

Product Design Case History
- Appliances
- Electronic Apparatus
- Industrial Machinery
- Miscellaneous

Production and Assembly Techniques
- Automatic Assembly
- Embedded Circuits and Components
- Hermetic Sealing
- Miscellaneous
- Printed Wiring
- Soldering and Solderless Techniques
- Unitized Construction

Testing
- Components
- Environmental
- Materials
- Production
- Systems